THE

# TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

# CEYLON AGRICULTURAL SOCIETY.

VOL. XXXIV. COLOMBO, FEBRUARY 15TH, 1910. No. 2.

## Science and Industry.

It may appear to some that an apology is needed for the reproduction in an agricultural journal of Professor Sedgwick's eloquent address on "The Relation of Science to Human Life," which will be found on a later page of the present issue. It is true that almost the only direct reference which the speaker makes to agricultural or horticultural pursuits occurs in the course of a quotation from "A Winter's Tale"; and the reader whose profession is agriculture must therefore not expect to find anything bearing practically upon his own pursuits. We do nevertheless most strongly recommend this address to the attention of agricultural readers not only on account of its great general interest, but also because it points a moral which cannot be too thoroughly taken to heart by those who have to deal with the methods of applied science, that is to say, with any kind of industry.

Science, says Professor Sedgwick, simply means knowledge, and to speak of scientific knowledge, as opposed to ordinary knowledge, is to use a redundant phrase, always supposing that we are using the word knowledge in its strict sense. To speak of exact science or exact knowledge implies a similar misapprehension. Science or knowledge, which is not exact and accurate so far as it goes, is not worthy of being called knowledge or science.

A distinction is nevertheless almost invariably drawn between scientific and non-scientific knowledge, between scientific and non-scientific men. When the case is closely examined, the distinguishing features of the man of science are found to be that he applies himself in the first place to a particular branch of knowledge, and that he makes it his special business to extend the boundaries of knowledge within that particular branch.

Amongst the scientific men themselves two main classses are to be found, namely, those who apply themselves to technical science and to pure science respectively. The former are particularly engaged in adding to knowledge which is obviously useful; these are the inventors and pioneers in agriculture and other useful technical processes. The students of pure science, on the other hand, seek knowledge for its own sake: the desire to find out something new is with them an all-engrossing motive.

Now, it is a curious circumstance, and one which it was Prof. Sedwick's main object to impress upon his hearers, that almost all great advances in industry have been based upon discoveries in pure science—upon discoveries made by men

who paid no regard to the practical utility of their work and were careless of the technical application of their inventions.

Modern agriculture has laid almost all the pure sciences under contribution. The study of pure botany for its own sake has led ultimately in many cases to the discovery and introduction of new varieties of useful plants; and the development of miscroscopic botany has led to the scientific treatment of plant diseases. The contribution of the zoologist is closely comparable with that of the botanist, and the student of evolution and heredity has arrived at knowledge which can be applied to the development of new and useful varieties of animals and plants.

The applications of chemistry and geology to the study and improvement of soils are no less obvious, although the properties of soils are being discovered to depend more and more upon the existence of minute forms of living things. Numerous other instances might be cited to illustrate the importance of the pure sciences as applied tc agriculture.

The developments in other arts and industries which are based upon purely scientific discoveries react again upon agriculture. Thus the future of agriculture in the tropics is closely bound up with the study of tropical diseases—a study in which notable progress has recently been made, whilst Pıofessor Sedgwick's concluding remarks give us every reason for hoping that still more remarkable discoveries may be expected in the future. We know already that with proper precautions the danger of malaria can be averted to a very considerable extent, and the bearing of this fact alone upon the development of tropical countries can scarcely be overestimated.

Agricultural engineering is another subject which has made great strides, and the work of the engineer, no less than that of the dcctor, depends ultimately upon the labours of purely scientific discoveries.

Wherever the student of pure science leads the way there is generally no lack of technical experts nowadays to seize upon the new discoveries and apply them to industrial ends. For the latter form of occupation is so much more lucrative than the former that the ranks of applied science are continually being recruited from those of pure science at the dictates of mere necessity. Although the love of discovery for its own sake is a powerful motive, the trend of modern social forces must be expected to cause its appearance in a steadily diminishing number of those classes, the members of which can afford to follow their own inclinations; and there is thus a danger that the spirit of purely scientific discovery may seriously decline before the time arrives when public opinion shall be awakened to follow the lines so ably recommended by Prof. Sedgwick.

R. H. L.

## Review.

### AGRICULTURAL FERTILISERS.

BY A. D. HALL.

(From *Nature*, Vol. 81, No. 2086, October 21, 1909.)

Mr. Hall has again succeeded in producing a work which will appeal with equal force to the practical and to the scientific agriculturist, and will do much to overcome that innate prejudice of the ordinary practical farmer against science by showing him the enormous influence science has had in determining a rational system of manuring, and in giving him the knowledge of a variety of substances of use to him in his business of food production, as well as in securing for him a safeguard against adulteration by unscrupulous traders. In the history and evolution of the practice of keeping up the crop-producing power of the soil Mr. Hall examines critically the various theories of manuring adduced from time to time, and the experiments upon which they are based, and the study of merely this part of the work will be of supreme importance to the practical man and to the student in showing how experiments may be misconstrued and conclusions of the most erroneous description drawn.

The recommendations as to the manuring of farm crops are tempered with sound advice, and the impossibility of prescribing more than a generally suitable method of manuring without a careful study of soil and climatic conditions extending over some years is well demonstrated. Mr. Hall gives some timely warnings as to deductions from field experiments, of which there has been such a plethora in recent years, with their unscientific methods both of carrying out and of deduction. The importance of taking into account the experimental error, which is estimated at 10 %, and of neglecting results within these limits should be taken to heart by all who carry on these so-called "experiments."

The chapter on farmyard manure is eminently practical and useful, and recent work on such subjects as root excretions, effect of fertilisers on tilth, and on residual values of manures, brings the book well up to date. It is sought to distinguish between manures and fertilisers, the former designating more or less complete plant foods, the latter those materials which supply one element in the plant food, nitrogen, potash, or phosphoric acid. The perversion of the meaning of the word manure from its original significance, hand work, is no less curious than the use of the word tillage to mean artificial manures, which use still persists in the eastern midlands. The part of the work relating to lime is worthy of serious attention from all agriculturists, as it is probable that the lack of carbonate of lime in a soil is more often than any other cause an explanation of the comparative infertility or absence of satisfactory results from manuring. A chapter on the valuation and purchase of fertilisers puts this important method of calculation simply and accurately, and a concise statement of the Fertilisers and Feeding Stuffs Act will be useful to all users of manures.

Mr. Hall's remarks on the soil-inoculation question supplement and strengthen the advice he gave in his work on the soil, and the experiments on the new nitrogenous fertilisers, cyanamide and nitrate of lime, show the values of these fertilisers in terms of their competitors, nitrate of soda and sulphate of ammonia. The Rothamsted experiments are, of course, freely drawn upon to provide data, and in the hands of the present director of that station these results are being endowed with fresh life and excellently practical applications. The tables of results are concise and well arranged, so that the reader is not faced with an immense array of figures and tables, and bewildered without being enlightened. To sum up, this is a sound and scientific book which should be in the hands of every practical agriculturist as well as in those of the student, the teacher, and the manufacturer.

M. J. R. D.

# GUMS, RESINS, SAPS AND EXUDATIONS.

## WHAT HELPS TO KEEP RUBBER DEAR.

(From the *India Rubber World*, Vol. XLI., No. 2, November 1, 1909.)

No doubt it would seem reasonable to many minds, if not absolutely certain, that a heavy advance in rubber prices could not fail within a short period to lead to a corresponding increase in the output of rubber. This is the general commercial rule, and consumers of rubber seem generally disposed to apply it to rubber production. In view of present price conditions, however, it may be worth while to consider how the bringing of rubber to market differs from dealing in most other commodities. In the first place, however well systematized the production of rubber may be in portions of the Amazon valley, this condition does not extend to the whole region, and whatever improvement may be attempted, progress is necessarily slow, if for no other reason than the scarcity of population suitable for gathering rubber.

A large percentage of the rubber gatherers in Brazil to-day remain on the ground temporarily, so that each season a fresh immigration is necessary, very much as if the city of San Francisco should plan to lay new pavements six months in every year, and for each new piece of work should send to Italy for labourers, with the idea that most of them would return home after the work was finished. The rubber which is coming into Para to-day is being got out by *seringueiros* who were employed as long ago, perhaps, as January last, and most of the rubber to come out during the present cutting season will be the result of similar engagements. The fact that rubber is selling at New York for $1 a pound more than when rubber gatherers were last employed to go up-river naturally, therefore, will have little effect in the way of increasing this season's output. The high price level can hardly have a widespread effect upon the employment of rubber gatherers before next January, and the crop resulting from engagements made then will not all reach market before the summer of 1911.

But other conditions are to be considered than the labour supply. There is a scarcity of local capital. It is necessary for the *seringal* owner, particularly if far from the primary markets, to be equipped with supplies for his working force in advance for the whole season,

And not only this, it is necessary to make advances in respect of immigrants from Ceara, for instance, for their families and for transportation and the like, probably not less than 1 conto [= $62·50] for each labourer secured. It will be seen, then, that the *seringal* owner, in order to increase his present scale of operations, must have considerable capital in order to plan and lay out money practically a year ahead for the purpose. He must apply to the *aviadores* for accommodation, and as will readily be seen these firms are not always able to make larger than accustomed advances.

There are many *seringals* in the lower Amazon districts which for many years have yielded practically a fixed amount of rubber, without regard to the state of the markets. Owing to the habit of many persons in interest in these of living in Europe and drawing on the home houses for funds all the time, there is not always a reserve of capital at home with which to take advantage of new conditions in the market with a view to increased operations if such might prove desirable. It is even less easy to secure means whereby to extend rubber gathering rapidly in more remote districts. Of course, ultimately high priced rubber will lend a stimulant to increased collection, just as the world's growing demand for rubber, without regard to prices, has led to a larger output in nearly every year since the industry had a beginning. But the rate of growth has been too slow to lead to any hope that the increase in prices within the past twelve months will result in such larger production as to reduce prices before very many months to come.

There is to be considered, moreover, the development of new financial conditions on the Amazon, now coming to a head, whereby, with the aid of local banks, rubber may be stored instead of being thrown on the market immediately upon its arrival at Para, as was so long the case. If this new condition should have any effect whatever upon prices it will not be to make the price to consumers less. This is so plain as to require no argument.

It seems worth while to refer here to an interview which the *India Rubber World* had seventeen years ago with the Para merchant Vianna, who gained a reputation for putting rubber prices on a higher basis than had before been known, and doing so more than once, though each time a "slump" followed so quickly as to create a general opinion that attempting to "corner" rubber is bad business. Mr. Vianna said in 1892:—

"I have handled the rubber business in Para for years, and although it is generally and absolutely known both in the United States and in Europe that through my constant efforts in this market since 1879 the Para rubber crops have been sold to a much better advantage for the receivers and producers, still this is utterly ignored by said receivers, most of them believing that I have had nothing to do with the keeping and advancing of prices in the long period, although I have devoted all my attention and ability to such business all this time."

This, of course, was Senhor Vianna's compliment to himself, and we have no record of how his contemporaries at the time regarded it. But he said further that with few exceptions the rubber producers in those days and the original handlers of rubber as a rule knew nothing about how the rubber business was done abroad, and implied that his lack of local support prevented his doing more in the way of keeping up rubber prices. As he said:—

"What they know about this business is the difference, when there is one, between the prices offered by two different buyers, and they are smart enough to take the higher price of the two. This embraces all their knowledge about such an important business."

As has been pointed out in these pages, the business of rubber production on the Amazon recently has shown a tendency toward consolidation in the hands of persons with capital and with a broader knowledge of rubber conditions in general than in the past, so that, with the assistance of the banks as referred to, it is possible that concentration and co-operation may be brought about to an extent which would not have been possible in the days of Vianna's former activity in the trade. But the rubber business, back of the primary markets, remains strangely complex, and he would be a bold man who would claim to comprehend all its conditions. It would seem, however, that the conditions here outlined as having a tendency to keep up rubber prices are worthy of study.

There is no new question of ethics involved here. The world needs rubber, and rubber must be forthcoming, the same as ivory and innumerable other commercial commodities, the obtaining of which in the past has involved human slavery. The modern cotton in-

dustry depended for years upon human slavery in the Southern United States, but it does not to-day, and cotton is now being grown in many parts of Africa—the home of the former American slaves--by willing and well-paid natives. Ultimately, of course, the same will be true of rubber, though the progress toward the new conditions may be slow.

The hope of the civilization of the native rubber-producing regions, whether in Africa or in equally remote portions of South America, is in the development of such scientific treatment of rubber production as is now in progress in Ceylon, for example, and which the owners of capital ultimately will insist upon being carried out whatever rubber trees worth taking care of may be found.

We congratulate Mr. Labouchere, of London, upon his exposé of the conditions of rubber production in the region beyond Iquitos. In the first place, it will open the way to the correction of undoubted abuses in a specific region. Secondly, it will aid in simplifying the so-called Congo question, in showing that the conditions of rubber production in Central Africa are not, necessarily, due to maladministration in any quarter, but rather to the conditions under which business between civilized and uncivilized races must be done before a mutual understanding is arrived at as to what constitutes right or wrong. Finally—and this point has been stated before in this article—the disclosure of conditions in Peru will help consumers of rubber as a class to understand why rubber constantly becomes more costly rather than cheaper, as is the case of commodities produced under more desirable conditions.

---

## THE CULTIVATION AND PRODUCTION OF RUBBER IN THE GERMAN COLONIES.

By Dr. Paul Preuess.

(From the *India Rubber Journal, Quarter Century Number*, 1909.)

The German Rubber-yielding Colonies of Cameroon, Togo, German East Africa and German New Guinea can look back to-day upon twenty-five years under German government. In the near future, Samoa, which has belonged for ten years to Germany, will join the above-mentioned countries as a rubber-producing colony, as within the last few years rubber plantations have been developing there. Unlike the other German Colonies, Samoa has no native rubber plants. The climbing plant—*Parameria*—and *Ficus* species have been known in New Guinea for some few years. The rubber obtained therefrom, which is of good quality, has only reached Germany in samples of a few kilogrammes. Other rubber sent to the market from New Guinea is entirely from the plantations of the New Guinea Company. Cameroon, Togo and East Africa have, however, for some years supplied considerable quantities of wild rubber, which in the two first-mentioned places is chiefly obtained from *Funtumia elastica*, and to a small extent from species of *Landolphia*. In East Africa, on the other hand, vines are the chief source. Cameroon exported in 1907 3,284,184 lbs. of wild rubber to the value of £374,365; Togo, 360,347 lbs. to the value of £53,632, and East Africa (including 92,400 lbs. of cultivated rubber), 531,243 lbs. to the value of £78,945. With the export of 6,320 lbs. from New Guinea, Germany received from her Colonies in 1907 4,182,094 lbs. having a value of £508,400. Germany's consumption in raw rubber in the year 1907 amounted to 15,808 tons, and the quantity imported to 16,568 tons. It will be seen, therefore, that in 1907 Germany covered 1-14th of her requirements in rubber from her own colonies, and up to the present this proportion has not greatly changed.

Only a round 45 tons of the quantity mentioned came from the plantations in East Africa and New Guinea. This amount has risen in 1908 to about 87 tons, and should, with the addition of Cameroon rubber, reach 160 tons. Against this there is no doubt that the export of wild rubber will considerably decrease in the next few years. The question is, whether the plantations will be able to cover, not only the gradual deficiency in wild rubber, but also the continually increasing requirements.

Rubber cultivation in the German Colonies, compared with the age of the Colonies, is still very young. Some twelve years ago the first experiments were made there with the laying-out of plantations; there were then no rubber plantations of any importance yielding a profit in the whole world. Neither in the British nor Dutch Indies nor in Central America had the experimental stage been passed. At that time hardly anyone had an idea of the tremendous impetus the next ten years would bring to rubber cultivation.

At first all kinds of rubber plants were introduced into the German Colonies. In 1889, *Hevea brasiliensis*,

*Manihot Glaziovii, Ficus elastica*, besides various vines were brought into Cameroon and some years later to New Guinea, with the addition of *Castilloa*. Further, in 1889, *Funtumia elastica* was discovered in Cameroon and cultivated there. *Castilloa elastica* arrived in 1899, and in 1901 better varieties of *Ficus elastica* than had previously reached Cameroon. The first *Castilloa* plantations were soon found to be useless in West Africa on account of destructiveness of a species of cookchafer, *Inesida leprosa*, found there. Again experience has shown that the cultivation of *Manihot Glaziovii* does not pay in the wet climates of Cameroon and New Guinea, but gives better promise in the drier district of East Africa. The value of *Hevea brasiliensis* for cultivation first became evident in 1898 and 1899 when the correct method of tapping was discovered and tested in Peradeniya, Penang and Singapore.

Then the English in Ceylon, Straits Settlements and the Federated Malay States threw themselves with characteristic energy into this new cultivation, in which they were assisted by having a good supply of the necessary seed from many old *Hevea* trees already bearing fruit in the botanical gardens and individual plantations; the Germans could only proceed slowly, as the few specimens of *Hevea* in New Guinea and Cameroon only supplied seed sparingly. On the other hand *Ficus elastica* and *Castilloa elastica* in New Guinea, *Funtumia elastica* in Cameroon, and *Manihot Glaziovii* in East Africa increased freely.

The present state of rubber cultivation in the German Colonies may be illustrated by the following table of the planted areas :—

| | Hevea brasiliensis. | Ficus elastica. | Castilloa elastica. | Castiloa alba. | Funtumia elastica, | Manihot Glaziovii. | Manihot dichotoma. | Total avrage. |
|---|---|---|---|---|---|---|---|---|
| | acrs. | acrs. | acrs. | acrs. | acrs. | acrs. | acrs. | acrs. |
| Cameroon | 190 | 7½ | 11 | ... | 5,125 | 2½ | ... | 5,336 |
| Togo | ... | 1¼ | .. | ... | 127¼ | 160½ | ... | 289 |
| German East Africa | ... | .. | .. | ... | 37 | 25,155 | ... | 25,192 |
| German New Guinea | 1,045 | 2,847 | 1,297 | ... | 17½ | .. | 2½ | 5,209 |
| Samoa | 1,418 | ... | ... | 59 | 5 | 25 | ... | 1,507 |
| East Carolines | ... | 10 | ... | .. | 26 | 6 | .. | 42 |
| | 2,653 | 2,865¾ | 1,308 | 59 | 5,337¾ | 25,349 | 2½ | 37,575 |

This gives a total of 37,575 acres planted with rubber trees. Now taking the production of the individual species at the following averages:—1 acre of *Hevea* = 270 lbs., 1 acre of *Ficus* = 80 lbs., 1 acre of *Castilloa* = 180 lbs., 1 acre of *Funtumia* = 180 lbs., 1 acre of *Manihot* = 110 lbs., then the total yearly production of the planted area, when the whole is in bearing, will amount to close on 5,000,000 lbs. or about 2,230 tons, which is about the seventh part of Germany's total consumption in 1907. At present, however, only a very small part of the land under cultivation has reached bearing age.

### Hevea in Kaiser Wilhelm's Land.

The New Guinea Company possesses the oldest plantation in Kaiser Wilhelm's Land and the Bismark Archipelago. There the regular production of rubber commenced in 1906-7, in which year the yield amounted to 2,330 lbs.; in 1907-8 to 6,320 lbs., and in 1908-9 to over 6 tons of rubber. The greater part of this was obtained from *Castilloa elastica* and *Ficus elastica*, and only a small proportion from *Hevea brasiliensis*. All three sorts of rubber were considered to be first-class quality on the Hamburg market, and realised high prices. *Hevea* supplies the most valuable product, then *Ficus elastica* follows, and finally *Castilloa elastica*. When *Hevea* rubber was sold at 5s. 6d. per lb., *Ficus* realised 4s. 3d. per lbs., and *Castilloa* 4s. 1d. per lb. There is not the slightest doubt, therefore, that where conditions of soil and climate are favourable for *Hevea*, this is by far the most advantageous species of cultivation. In cheapness and facility of cultivation, in yielding capacity and the quality of the product, *Hevea* surpasses all other species. Already the difference is quite perceptible. It will, however, be still more apparent when the market is flooded with first-class *Hevea* rubber from the British Colonies and the prices begin to fall. As is known by experience, decreases in price are felt by the lower qualities to a far greater extent than by the higher qualities, and when offers are plentiful, the former are very easily left altogether unsaleable. Wherever it is possible, therefore, *Hevea* should be planted, since only the best product can sustain prolonged competition. Most German rubbers planters are probably aware of this, and whilst, until recently, they experienced a lack of *Ficus Funtumia* and even *Castilloa* seeds, they have now turned their attention very strongly to *Hevea*. The oldest stock of this species in Kaiser Wilhelm's Land can now supply abundant quantities of seed for the protected territory of New Guinea, and young plants in the form of "stumps" are transported to Samoa and Cameroon from Ceylon. The question of seed supply can therefore be regarded as having been gradually solved.

The cacao plantations in the Bismark Archipelago have almost exclusively

been laid out without proper shade trees, and as mixed plantations of *Hevea* with cacao. Also the Liberia coffee plantations have been interplanted with *Hevea* and *Castilloa*. In a similar way *Hevea* is being planted together with *Cola vera* and *Fourcroya gigantea* in Cameroon.

East Africa and Togo do not come into consideration for the cultivation of *Hevea*.

The distances in planting are 16½ ft. × 16½ ft., 26½ ft. × 33 ft., and 33 ft. × 40 ft. The tapping of *Hevea* is done as in Ceylon. The rubber is only produced in sheets, and, of course, the quantities produced are still very small.

CASTILLOA ELASTICA.

The *Castilloa* plantations supply larger quantities of cultivated rubber at the present, because it has been found necessary to tap trees to death as well as to thin them out where they have been too closely planted. From lack of labour and in order to reduce the cost of clearing and of upkeep, the trees were planted too thickly, often at distances of 6, 8 and 10 feet apart. The object was to find out in what degree close planting would afford a substitute for shade. The experiments have shown that a distance of 6 or 8 ft. between the plants is too close, as thinning out of the trees must be commenced before they are sufficiently mature to be tapped. Further, trees, three to five years old, yield rubber very rich in resin. By planting at a distance of 10 ft., with not too luxurious growth, the trees can generally attain an age of six years before it is necessary to thin them out. The rubber is then much better. This method of planting may be recommended, or it can be advantageously substituted one of 8 ft. × 11½ ft.

A certain amount of shade, afforded by planting suitable trees, appears to be necessory for *Castilloa*, if the trees are not to become poor and impoverished.

The cultivation of *Castilloa* is, as a rule, attended with more difficulties than that of other rubber trees, in spite of its early vigorous growth.

In New Guinea tapping is done with a single blade having a semi-circle edge. The tapping system employed is either the half—more rarely the complete—herring-bone incision with about five side branches on each side. The main channel is kept shallow, but the side branches are cut with a sharp knife right to the wood. Cuts which lay the wood bare flow far quicker than those in which this is not the case. With regard to this, care has to be taken that certain parts of the bark which run parellel with the axis of the trunk remain quite uninjured.

The latex is first collected in cups and mixed with a considerable amount of water, stirred, filtered, and poured into casks. After the cream has risen to the surface, the water is run off, and after eighteen to twenty hours, with renewed stirring, replaced with fresh water. This process is then repeated once more. On completion of the two treatments the rubber then floats as a thick cake on the liquid. The caogulated mass is removed, cut into pieces and passed once through the rollers. By this the rubber is largely freed from moisture and acquires a high degree of firmness and elasticity. The sheets thus obtained are soaked for a short time, then superificially dried at a moderate degree of heat in the drying-house, pressed into cube-shaped blocks of about ½ cwt., and are then ready for transport. *Castilloa* rubber stands shipment better in the moist state than when quite dry. Long exposure to a high pressure in the press when forming the rubber into balls does not have a good effect upon the quality. The pressing should be done quickly and strongly. Also in washing the scraps by means of washing rollers, the quality will be so much the worse the oftener the scrap has to pass through the rollers.

Any uncoagulated latex left in the casks after the removal of the rubber layer is skimmed off, and by pouring it into almost boiling water the rubber it contains is made to separate. The preparation of *Castilloa* rubber is somewhat wearisome when compared with *Hevea*, as the washing of the latex may require two days.

In Samoa *Castilloa alba* is cultivated entirely in place of *Castilloa elastica*. Tapping, however, has not yet commenced. The *C. alba* has several enemies, in Samoa a spongy fungus, *Hymenochoete noxia*, grows on the main root, and in New Guinea it is attacked by cockchafers and boring beetles.

FICUS ELASTICA.

The cultivation of *Ficus elastica* in Cameroon, Togo and the Carolines has not yet passed the first stages. In New Guinea, however, it has become relatively extensive, as it offers no difficulties, the tree grows well and the rubber is of very good quality. At first the plants are distanced 18 ft. × 18 ft. This is ultimately increased to 36 ft. × 36 ft. Tap-

ping to death and thinning out begin at the age of six years. In order to obtain as large a surface for tapping as possible, aerial roots are propagated on the remaining trees. In tapping, a number of oblique parallel cuts are made on the trunk and main branches. The same tapping instrument is used as with *Castilloa*. The cuts which act as channels are likewise cut with a sharp knife. The latex is collected in cups with some water, filtered, and the rubber separated by boiling. As the flow of latex in six-year-old trees, where closely planted, is only small, the whole of the rubber is allowed to solidify in the wounds and is then obtained as scrap. *Ficus* scrap is very much better than *Castilloa* scrap. It is of a reddish colour, very solid, elastic and dry. It realised only 1½d. per lb. less than *Ficus* sheets in block form. In consequence of this, most of the *Ficus* rubber has been prepared as scrap, and for this purpose the incisions are preferably made in a horizontal direction.

The yield of six-year-old closely-planted trees amounts by thinning-out to about 2 oz. per tree. Trees of the same age standing singly produce some three to four times this quantity. Approximately the same proportions occur as with *Castilloa*, for instance, isolated six-year-old trees gave over 4 oz., whilst closely planting specimens gave only 1 oz. per tree.

### FUNTUMIA ELASTICA.

This species has been cultivated experimentally in all German Colonies, but only in Cameroon to any great extent; about 5,000 acres have been planted there with this species. It is generally planted very close, but probably here also an initial distance of less than 10 ft. between the plants offers no special advantages.

From the tapping of wild *Funtumia* trees, it is known that this species yields latex more readily than others, and that it is almost as sensitive to drastic tapping as *Castilloa*. Tapping of the cultivated tree has occurred experimentally in Cameroon; these trees, however, do not stand closely planted, but singly or in rows, and the results must be judged accordingly. It can be assumed that from 3 to 3½ oz. are to be expected from six-year-old trees planted at good distances from each other, and 1 to 2 oz. from closely planted trees.

The method of tapping practised in the last experiments with *Funtumia* differed from all other methods, in that verticle incisions the whole length of the trunk were made. As to its advantage over the herring-bone system, further observation and a more extended series of comparative tapping trials are first necessary.

The rubber is procured by boiling the latex after diluting it with water; treatment with hydrofluoric acids yields a better product. Although *Funtumia* rubber is at present inferior in quality to that of *Hevea* and *Ficus*, and at most is equal to that of *Castilloa*, still it may be confidently anticipated that with more suitable preparation it will yield a good serviceable product.

### MANIHOT GLAZIOVII.

It will be more difficult to find a process in East Africa by which the medium quality rubber from this species can be converted into a suitable quality, corresponding to the demand of manufacturers. By the tapping method generally in use in East Africa, the rubber is exclusively obtained as scrap, as the latex flows too scantily from the incisions in the bark for it to be collected in cups. The tapping process therefore consists of making punctures in the bark with knives, in a definite manner, after it has been coated with a coagulating medium. The exuding latex coagulates immediately and the resulting rubber is obtained as scrap. This scrap is inferior in quality to *Castilloa* and *Funtumia* rubber. In British Central Africa good results are obtained by tapping *Manihot* according to the method customarily employed for *Hevea*, which depends upon good response, together with the use of the herring-bone incision and by moistening the incision with ammoniacal water; for instance, in a tapping period of over nine months, 15 oz. of pure rubber per tree were obtained. Likewise in Togo, by means of the herring-bone system, trees, not yet six years old, produced in five days, on the average, 12 oz. of rubber as latex, and barely five year old trees averaged 2¼ oz. There are single old trees which yield up to 12½ lbs. of rubber a year, whilst on the average only about 275 lbs. can be reckoned from an acre of 400 trees. As the *Manihot* becomes ready for tapping much earlier than all other kinds of rubber trees, its cultivation offers many advantages.

Amongst other rubber-yielding plants which are cultivated experimentally here and there in the German Colonies may be mentioned the *Manihot dichotoma, Manihot piahuyiensis, Ficus Rigo, Ficus Schlechteri, Foresteronia floribunda*, various *Landolphia* species, *Mascarenhasia elastica*, and so forth. However, all these species have very little interest for cultivation on a large scale.

### The Supply from German Colonies.

In conclusion, there remains the question as to whether Germany will ever be in a position to supply her own demands in rubber from her own Colonies. In answering this question, three factors must be taken into consideration: (1) Soil, (2) Climate, (3) Labour. Regarding soil, the Colonies of Cameroon and New Guinea alone possess several hundred thousand acres of land suited for the cultivation of the most valuable rubber trees. The climate there is also very favourable. Taking the annual requirements of Germany in rubber at 16,000 tons, this quantity can be produced from an area of 150,000 to 170,000 acres exclusively planted with *Hevea*, and from 200,000 to 250,000 acres under cultivation with the various species already planted, but with *Hevea* predominating. Even if the demand for the raw material should considerably increase, the answer to this would be an affirmative as regards soil and climate; whether, however, with the accompanying development in the cultivation of cacao, cotton, coconut and oil palms, etc., the necessary labour will be procurable for such an extension in cultivation, the question cannot be answered.

## PALO AMARILLO.

From the *Kew Bulletin, of Miscellaneous Information*, No. 9, 1909.)

*Palo Amarillo* (*Euphorbia fulva*, Stapf; syn. *E. elastica*, Altamirana and Rose, not of Jumelle).—Some particulars regarding this plant as a new source of rubber appeared in the *Kew Bulletin*, No. 7, 1907, p. 294. The following supplementary information upon the subject is gathered from an illustrated article on "The Rubber Plants of Mexico" by Dr. H. H. Rusby in "Torreya," Vol. 9, No. 9, September, 1909.

From this paper it appears that the "Palo Amarillo" will not grow upon the alluvial plains of Mexico but only on the rocky hill-sides where the drainage is good. The bark is described as being thick and succulent, at first smooth and of a light yellowish-green colour. That of the trunk and large branches soon excoriates in large, very thin, papery, translucent sheets of an orange-yellow or orange-red colour, which impart to the tree a shaggy appearance, and a colour that has given the trunk its vernacular name "palo amarillo" or yellow trunk.

The flowers appear in January or thereabout, before the appearance of the new leaves, and the fruits mature in June and July.

As soon as the bark is wounded, a milky juice exudes which is very irritant and capable of producing violent inflammation of the eyes if it enters them, as it is quite liable to do in spattering, when the tree is cut.

The great value of this tree as a rubber producer lies in its abundance over large areas and the proximity of the trees to one another facilitating collection of the milk, as well as the ease with which it can be propagated and the rapidity of its growth.

All that is necessary for propagation is to thrust the newly-cut branches into the soil, where they practically all grow. From them the tree reaches its full size in from 5 to 7 years. These considerations appear to incline Dr. Rusby to the opinion that if all other sources of rubber were to fail, this one could probably supply the world's entire requirements.

The properties of the "palo amarillo" rubber are peculiar. Taken by itself it is of only medium quality, but mixed in suitable proportion with other varieties, especially with para rubber it markedly improves them.

J. H. M.

# FIBRES.

## THE INTERNATIONAL COTTON FEDERATION.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 12, December 1, 1909.)

The wonderful solidarity established within the past few years among the cotton spinners and manufacturers of Europe has been strikingly illustrated by the almost universal restriction of production during the crisis with which the industry is faced. In all the countries affiliated to the International Cotton Federation short time working has been in force for some time past, and an intimation was recently received by that organisation from the United States to the effect that the leaders of the industry there desired to co-operate in the general movement. Subsequent reports by telegraph show that restriction of output is being resorted to in the American mills on an extensive scale, and an amelior-

ation in the condition of the industry is therefore looked for. A statement issued by the International Federation in reference to the supply of raw material indicates that the cotton crops of the world for the present season are expected to suffice for the requirements of the trade even should the American crop prove to be only a moderate one. The Committee of the Federation, however, point out that if full time were resumed the result, in view of the enormous enhancement in the price of raw cotton would be injurious to the interests both of the industry and of the consumer. "The burden on the consuming public," they add, "may be judged from the fact that if the present American crop were disposed of at the present high level of prices, the increased value in comparison with the range of prices in force six months ago would amount approximately to £50,000,000 sterling, part of which would be borne by the European cotton industry and by the consumers of its productions, and the balance by the American cotton manufacturing industry and the consumers of its productions." These figures are certainly startling, illustrating, as they do, the far-reaching effect of a pronounced rise in raw material. The primary object of course of the International Association is to protect the interests of the trade it represents, and it certainly has attained an influence which is unparalleled in industrial history. Although it was established as recently as 1904, with its headquarters in Manchester, no fewer than twenty-two cotton-using countries are co-operating in its work, while its committee includes a representative of each important manufacturing country in Europe and also a representative of Japan. Mr. C. W. Macara, the leader of the Lancashire industry, who is Chairman of the Committee, in explaining recently the genesis of the short-time movement, declared that it was rendered essential by wild speculation in the raw material, which had completely upset confidence, and caused a reduction of demand from the great markets of the world at a time when over-production of manufactures and general trade depression were rife. But the energies of the Federation are not confined to this one aspect of the cotton problem. At its sixth International Congress held in Milan during the present year, the subjects considered ranged over a wide field, including the expansion of existing cotton growing areas and the opening up of new ones, the more scientific cultivation of the raw material, the International standardisation of grades of cotton, and many other subjects of practical importance. The question of dealing with the operations of speculators and of ensuring an adequate supply of raw material has for many years given rise to anxious thought. Among the schemes brought before the Congress was one which proposed the formation of a limited company comprising the entire cotton industry of the world, whose function would be to purchase a huge quantity of raw material to be maintained as a reserve until prices reached a fixed limit, when it would be sold to spinners, This project was the subject of an interesting discussion in which some delegates opposed it as impracticable, while others maintained that the working of short time has proved the most effective method of fighting a "corner." The subject, however, is to be kept under consideration, though at the moment the weight of opinion appears to be against its adoption. It is beyond dispute that over-production in Lancashire has been largely brought about by excessive building of mills during periods of prosperity, but how this is to be checked is a problem difficult of solution. The striking fact of the moment, however, is the remarkable position which the International Federation has attained, notwithstanding the obstacles that inevitably stand in the way of co-operation among countries which keenly compete with each other in neutral markets.

---

## BRITISH COTTON-GROWING.

### Progress in West Africa.

(From the *Indian Trade Journal*, Vol. XV., No. 185, October 14, 1909.)

The sixty-seventh meeting of the Council of the British Cotton-growing Association was held at the offices of the Association on September 7th, the President, Sir Alfred L. Jones, in the chair.

A considerable quantity of cotton is now coming forward from British East Africa and Uganda, and the outlook continues very favourable. In Nyasaland also the industry is making considerable progress, both amongst European planters and also the native population, and the quality of the cotton is gradually improving.

### West Africa.

The purchases of cotton in Lagos for the month of August are 323 bales, as compared with 137 bales for August last year and 545 bales for the corresponding

month of 1907. Since the beginning of the year the purchases of cotton in Lagos amount to 11,489 bales, against 5,214 for the first eight months of last year and 7,824 bales for 1907. The progress made was considered very satisfactory, and there is every probability that the estimate of 12,000 bales for the year will be exceeded. Proposals have been submitted by the Government for the inspection of all cotton. The Association have approved of these suggestions, provided that the measures to be taken are not too drastic, as it is considered that this Government inspection will tend to improve the quality of the cotton, more especially as the natives are already accustomed to similar restrictions in connection with other products, where good results have accrued from such inspection.

The President congratulated the Association on the great success which had already been attained in West Africa. He stated that there was no better evidence of the necessity for the existence of the Association than the present condition of the cotton market, and expressed the opinion that the Americans would continue to use more and more of their own cotton each year, and unless Lancashire looked out for fresh sources of production she would very shortly find herself without any adequate supply of the raw material. Sir Alfred Jones also drew attention to the improved methods of baling introduced by the Association, and pointed out that the cotton brought from West Africa in Messrs. Elder, Dempster & Co.'s steamers measures 80 cubic feet to the ton, whereas that from New Orleans measures 113 cubic feet per ton. Many Americans have visited the docks at Liverpool, and have been much impressed by the neat and compact manner in which the Association's cotton is baled as compared with American cotton.

### West Indies.

The season which is now closing has been a fairly successful one in most of the Islands. Most of the cotton produced has been of excellent quality, and has always found a ready market. It has been proposed that another deputation of Lancashire spinners should visit the West Indies early next year.

It was reported that the Hon. Francis Watts, C.M.G., who has succeeded Sir Daniel Morris as Imperial Commissioner of Agriculture for the West Indies, had promised to visit Manchester on the 14th instant, and it has been arranged to hold an official meeting in the afternoon and to give a dinner to Dr. Watts in the evening.

### An Appeal for Funds.

The total capital subscribed to date amounts to £261,453, and as additional capital is urgently required to carry on the work, it was considered that the time was now opportune to appeal to the Lancashire cotton trade for further funds.

---

## PAPER-MAKING IN INDIA.

(From the *Madras Mail*, October 25, 1909.)

In the course of a review of Mr. H. W. Emerson's Monograph on the papier-maché and paper-making industries of the Punjab which we published some weeks ago, we pointed out that as wood-pulp in foreign countries become more and more difficult to obtain, and consequently dearer in price, many think a good time will come for Indian paper-makers. This opinion appears to be held also in influential quarters in India, for it is stated that official aid is to be given with a view to placing the paper-making industry on a firm basis, and that the Imperial Forest Research Institute is about to take steps to demonstrate the practicability of wood-pulp for India. A contemporary writing in this connection, recently, stated that "it has been known for many years that the necessary materials in the shape of fibres, grass and bamboo are procurable in abundance practically all over this country, and the cost of labour is far below that prevailing in any country now competing for the paper trade of India." It is, however, a great mistake to think that all that is required to establish a paper-making industry in a given spot is an abundance of fibrous material and cheap labour. The paper fibre and pulp expert tells us that the finest natural supply of raw material in the world may be valueless unless it is associated with the manufacturing factors necessary to financial success, which really require even more careful surveying and testing than the raw material itself.

What the capitalist wants to know is where he can manufacture successfully, the conditions under which he will have to work, conditions of the quantity of raw material available, native chemicals, labour, freight, power, fuel, water, natural facilities and advantages of sites, etc. He says, reasonably enough, that he is willing to risk his capital provided he can obtain this information beforehand, but that it is the business of the various Governments concerned, the big land-

owners and others who have got bamboo to sell, and who desire to see new industries established in their territories, to take some steps to advertise what they have got to offer. What is wanted are accurate surveys by competent experts to determine, not whether bamboos, etc., will make paper, but the whole and complete pulp-making possibilities and facilities of the territories and districts where bamboo is already known to exist in abundance.

The object-lessons of complete exhaustion of the spruce and pine forests in America and serious depletion elsewhere are no longer being ignored by the Governments who still possess large reserves. Canada in particular has embarked on a policy of severe restriction aimed at conserving her resources for future timber, rather than present paper supply. Thus, to exhaustion in one direction is being added restriction in others, and the net effect is, to quote the *World's Paper Trade Review*, the leading organ of the trade, that "wood-pulp has reached its limits of expansion, and to maintain the present growth of paper consumption an additional source of material must be found." Fortunately the world is so rich in paper-making material that absolute famine is unthinkable, although there may be considerable scarcity while the slow process of transferring the industry from its present locations to a new and largely different set of conditions is being accomplished. In India alone more material is said to be wasted annually in forest fibres than would supply the world several times over. Mr. W. Raitt, who has devoted several years to the study of the exceptional facilities for pulp manufacture afforded by India and Southern Asia generally, and has been contributing a series of interesting articles on this subject to the *Tropical Agriculturist*, reports that in Himalayan spruce, bamboo and certain fibrous annual grasses there is sufficient raw material available in India to produce hundreds of millions of tons of paper annually, and since the bamboo and grasses are self-reproductive, there is no danger of their exhaustion, as in the case of spruce. But he, too, repeats the warning, given expression to above, as to raw material being by no means everything, and as to the need of the capitalist having a careful survey of the manufacturing factors necessary to financial success made before deciding to incur any larger outlay.

Since it appears certain that a considerable amount of the capital now employed in pulp production must be gradually diverted from Europe and America by lack of supplies, it would seem desirable that those countries possessing natural facilities for such manufacture should make a bid for the trade which will thus be going a-begging, which trade will naturally drift to the localities which can make the best display of their resources. It is pretty well-known at present that in South America, Africa and Southern Asia there are unlimited supplies of raw material capable of making paper, but scarcely anything is known as to whether the conditions, under which it exists, are such as will render feasible the making of both paper and money. It would seem, therefore, that if India wishes to make a bid for this trade, the authorities should lose no time in embarking upon a thorough survey and exploration of her resources in this direction. This, as stated above, is primarily a matter for Governments to undertake, but much could be done also by local authorities and land-owners who possess reserves of material, finding out and making known what they are worth. In this connection India should take a hint from the United States, where the Government, as soon as they realised that their domestic resources were approaching an end, instituted an enquiry and investigation regarding those of the Philippine Islands, and this is now being conducted,

# DRUGS AND MEDICINAL PLANTS.

## THE FERMENTATION OF CIGAR-LEAF TOBACCO.

By J. C. Brunnich.

(From the *Queensland Agricultural Journal*, Vol. XXIII., Pt. VI., Dec., 1909.)

The fermentation or sweating of cigar-leaf tobacco is of the greatest importance to produce an aromatic leaf, free from harsh, bitter or other objectionable taste. A large amount of work of investigating this process has been carried out in the United States of America, and the results of the experimental work with Florida and Connecticut cigar-leaf are given in Report No. 60—"Temperature Changes in Fermenting Piles of Cigar-leaf Tobacco," by Milton Whitney and Thos. H. Mears.

In the course of these experiments Dr. Loew made an examination of the different leaves, which led to a discovery of the greatest practical importance. Dr. Loew proved that the curing and fermenting of tobacco is not due to the action of certain bacteria as stated by many authorities, but is caused mainly by the oxidising action of soluble ferments or enzymes, called oxidase and peroxidase. He showed that the formation of these important organic compounds can be increased by certain treatment of the leaves, as by slow drying of the leaves in barns or sheds, and, again, can be completely prevented from developing when the leaves are suddenly dried by a dry warm wind.

For the most favourable development of the oxidases a suitable amount of moisture in the leaves is an absolute necessity, but an excess of moisture again will be detrimental. The presence of the enzymes, oxidase, and peroxidase is absolutely necessary to produce the proper fermentation of the tobacco leaves, which takes place with a considerable rise of temperature. The Florida leaf shows a particular vigorous fermentation, with great heating, whereas the Connecticut leaves fermented slowly without much increase of temperature, and, therefore, the fermentation failed to destroy by oxidation many of the undesirable substances contained in the tobacco.

Mr. R. S. Nevill, the Tobacco Expert of our Department, noticed a similar trouble in some of the cigar-leaf tobacco grown at Bowen, and he submitted two samples of cigar-leaf from the same crop to be tested in accordance with Dr. Loew's method for the presence of oxidase and peroxidase. One of the samples—unfermented leaf—had hung in the sheds for months, subject to weather changes, the other sample—fermented leaf—was stripped and packed in boxes early in the season.

The fermentation was unsatisfactory by reason of the very low rise of temperature (106 degrees) obtained, and Mr. Nevill attributes this to insufficient amounts of oxidase and peroxidase present. Our tests distinctly proved the *complete absence of both oxidase and peroxidase* in the unfermented leaf, and the presence of peroxidase and absence of oxidase in the sweated sample.

Mr. Nevill explains the entire absence of the oxidising enzymes in the unfermented leaf to its having been so long exposed to the weather changes, and I believe this to be correct, particularly if the tobacco was dried very suddenly by warm winds. That some of the enzymes develop in the sweated leaf shows the advantage of preventing such exposure by bulking the tobacco as soon as dried sufficiently. The accurate judging of the amount of moisture is, as already explained, of utmost importance, and we will never be able to produce a high-class cigar-leaf if strictest attention is not paid to all details of stripping, drying, and bulking, as all the operations have an influence of the amount of oxidases formed in the leaves, and without the presence of oxidases a proper fermentation is an impossibility. Based on this investigation, Mr. Nevill makes the following suggestions:—Drying-sheds should be made of grass or wood, to be closed or kept open as desired, so that the tobacco could be dried slowly under uniform conditions, and be protected from extremes of heat and wind, so that the oxidising enzymes may be developed and preserved for the subsequent stages of fermentation.

It would be of particular interest if next season more samples of tobacco, treated under various conditions and in different classes of sheds, were submitted to us, in order to be tested similarly for the absence or presence of oxidising enzymes.

## MEMORANDUM ON THE PRODUCTION, DISTRIBUTION, SALE AND PHYSIOLOGICAL EFFECTS OF COCAINE.

BY WYNDHAM R. DUNSTAN.

(*Enclosure to Despatch No. 602 of 26th November.*)

Imperial Institute,
South Kensington, London, S.W.

The Commercial supply of coca leaves, the drug from which the alkaloid cocaine is obtained, is almost entirely derived from Peru and Java. The leaves are also cultivated in Bolivia, Brazil and other parts of South America, but only very small quantities are exported from these countries.

There is also a small amount of coca cultivation in Ceylon, but no statistics of export are available. It is estimated, however, that the total export of the leaves from Ceylon in 1909 will be from 15,000 to 20,000 lb., so that the total is small in comparison with the exports from Peru and Java.

Experimental cultivation of coca leaves has also been undertaken in India, the United States, the Federated Malay States and elsewhere, but at present there appears to be no production on a commercial scale in these countries.

From Peru both coca leaves and cocaine are exported. The cocaine produced is crude and impure, and is mostly exported to Germany, where it is refined. The Peruvian coca leaves are said to be sent mostly to Germany and the United States. From Java, coca leaves only are exported at present, though it has been proposed to open a factory there for the manufacture of cocaine. The coca leaves exported from Java contain little or no cocaine, but they are rich in other alkaloids from which cocaine can be made by a comparatively simple process. All the Java coca leaves are at present said to be worked up in Holland for the manufacture of cocaine.

The statistics of export of coca leaves and cocaine from Peru and Java, so far as they are obtainable, are given in the following table:—

| | Java. Coca leaves. lbs. | | Peru. Coca leaves. |
|---|---|---|---|
| 1904 | 57,032 | ... | About 1000 metric tons of coca leaves are stated to be exported annually from Peru at the present time. |
| 1905 | 151,057 | ... | |
| 1906 | 274,259 | ... | |
| 1907 | 533,765 | ... | |
| 1908 | 1,026,022 | | |

| | Cocaine kilos. |
|---|---|
| 1904 .. | 7,527 (5,156 kilos. to Germany) |
| 1905 ... | 6,778 (6,413 ,, ,, ) |
| 1906 ... | 5,914 (5,184 ,, ,, ) |
| 1907 ... | 6,057 |

The imports of coca leaves from Peru to the United States and to Hamburg in recent years are given in the following tables:—

*Imports of Coca Leaves to United States.*

| | Quantity. lb. | | Value. Dollars. |
|---|---|---|---|
| 1904-5 ... | — | ... | 342.518 |
| 1905-6 ... | 2,650,141 | ... | 488,545 |
| 1906-7 ... | 1,515,616 | ... | 212,424 |
| 1907-8 ... | 633,121 | ... | 76,109 |

*Imports of Medicated Leaves to Hamburg from Peru.**

| | | |
|---|---|---|
| 1905 ... ... | 618,600 | kilos. |
| 1906 ... ... | 587,400 | ,, |
| 1907 ... ... | 354,800 | ,, |

Imports of coca leaves and cocaine are not shown separately in the Trade Returns for most countries, including the United Kingdom, so that it is impossible to arrrive in this way at an approximate figure for the producing of cocaine. If the exports of coca leaves from Peru may be taken as about 1,000 metric tons per annum, and the exports of cocaine from the same country as about 6,000 kilos, then taking the Java output of coca leaves at the figure for 1908, viz., about 1,000,000 lb., the maximum possible production of cocaine per annum would be from 18,000 to 20,000 kilograms (39,000 to 44,000 lb.) but this is little more than a guess at the actual production, since a large proportion of the coca leaves which appear in commerce is no doubt used in the preparation of such products as "coca wine," "liquid extract of coca leaves," etc., and is not employed for the production of cocaine.

16th November, 1909.

## COCA CULTIVATION IN PERU.

(From the *Chemist and Druggist*, Vol. LXXV., No. 1, November 27, 1909.)

In a recent number of "Der Tropenpflanzer" (1909, No. 8, p. 386) Herr Sperber states that, owing to the increasing use of cocaine, there has been in recent years a very large demand for Peruvian coca-leaves, so much so, that the natural forests of coca-bushes

*Probably mainly coca leaves: the figure given for 1906 is quoted in the Hamburg Trade Returns as for coca leaves.

in the provinces of Huanuco, Otuco, and Urubamba are beginning to show signs of exhaustion. This difficulty is increased by the primitive and uneconomical methods of collecting the leaves indulged in by the coca-gatherers. Under these circumstances the formation of plantations of coca-bushes is now being undertaken in the country, and a brief account of the method of cultivation is given. It is recommended that the land selected for cultivation should have its existing crop cut, and *débris* from this piled in heaps and burned. This has the advantage of destroying insect pests. The plants are best raised in nurseries, and for this purpose a seedbed on good rich soil should be selected, dug to a depth of about 12 in., and the seeds sown therein at distances of 18 feet from each other. The seed should not be deeply buried in the earth, but should be merely lightly covered with a layer of fine soil. Coca-seed does not keep well, and should not be collected for sowing-purposes more than eight before it is required for use. Fresh seed germinates in about fifteen days, and as soon as the embryos appear every care should be taken to keep the seed-bed free from weeds. When the seedlings are 8 to 12 in. high they may be transplanted to their final position, and this is usually possible from four to five months after sowing. It is advisable to shade the seed-beds, and also the transplanted seedlings, from bright sunshine, and to cover them on cold nights. In the plantation each plant should be allowed a pace of about 40 sq. in. With care plants may also be raised from seed in plantations, and in this case the soil should be well worked over and the seeds put in at a depth of about fifteen times their length, and again lightly covered. Three or four seeds should be placed in each hole, and when the seedlings have reached a height of 4 to 8 in. the strongest should be selected in each case and others pulled up. Seeds are obtainable in Peru at the beginning of the rainy season, *i.e.*, November and December—and planting must therefore take place about this period. The plantations need little care except weeding, and the collection of leaves may begin when the plants are two years old, and may be continued for from ten to twenty years provided the plants are properly treated and are grown on good soil in suitable situations. A catch-crop of maize or tapioca may be taken between the coca-plants in the first two years, so as to get a return from the plantation and to afford the necessary shade.

# EDIBLE PRODUCTS.

## SINGLE PLANTING OF PADDY.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 10, October 1, 1909.)

The Director of Agriculture, Madras, sends us the following :—For some time the Agricultural Department has been advising ryots to adopt the system of planting paddy with single seedlings. In the Kistna Delta this is and has always been the ordinary practice, and few better paddy crops are to be seen in the Presidency. Single seedling planting has also gained a footing both in Tinnevelly and in the Tanjore Delta, and in both these districts some thousands of acres are now planted in this way.

Ten varieties of paddy, which are cultivated in the South of the Presidency in the Samba and Pisanum season, were last season grown by planting with single seedlings. With the exception of the Jeeraka Samba (a very fine paddy which makes up for its low yield by the excellence of its grain) all have yielded, better than the local Samba grown by ryots, in the ordinary way, but with similar manuring yielding, on an average for nine varieties, half as much again as was obtained by ryots in the locality. This, however, is not the end of single seedling planting. It is found that seed saved from a singly planted crop is much superior to seed saved from a crop planted in bunches of several seedlings. The reason for this is not far to look. When a single plant of paddy is planted, it is given all the space, soil and manure which usually go to 15 to 20 seedlings when planted in bunches; it can easily be understood that such a plant is more robust and therefore can fill the grain which it forms much better than any of the 15 to 20 plants which have a struggle for existence one against another. Not only is this the case, but the seedlings raised from seed obtained from such a plant tend to reproduce the peculiarities of its parent, and if such a parent plant tillers well, the next generation tends to develop an increased power of tillering and consequently to give a greater yield. This has to some extent already been proved at the Palur Agricultural Station. In

1907-08, "Garudansamba" planted on 16 different plots gave an average yield per acre of 1,952 lbs.; in 1908-09 the same plots planted and manured in the same way gave an average yield of 2,264 lbs. Only in this latter case seed had been specially selected from those plots which had been planted with single seedlings. Hence the increase per acre of 312 lbs. can only be put down to the improved seed as all other conditions were practically identical.

Very few experiments have been made with any of the "Kar" varieties of paddy except on the West Coast, where the varieties of paddy, which were tested at first, showed hardly any powers of tillering. These have now been tested three years, and the last two years the seed has been specially set apart from crops which had been transplanted with single seedlings. In the first year each plant had only one or occasionally two shoots. In the second year many of the plants had three shoots. In the third year nearly all the plants had three shoots and some as many as five. Thus at present crops planted with three or four of such seedlings in a bunch give better yields than singly planted crops, but as the tillering power develops gradually the singly planted crops, though even now much superior to the ordinary locally planted crops, are overtaking in yield those planted with 3 to 4 seedlings.

To plant paddy with single seedlings it is necessary not to sow too much seed in the seed-bed. To plant one acre, a seed-bed of seven cents, sown with seven Madras measures of paddy, is ample. If possible "Punnidinathu" should be adopted in preference to "Sithiranthu." The seed-bed should also be manured with well-rooted cattle manure and ashes so as to give the seedlings a good start. The seedlings should not be too old when transplanted, seven days for every month of the crop may be allowed; thus for a five-month crop the seedlings should be not more than 35 days old.

Some difficulty may at first be experienced in getting the transplanting coolies to transplant single seedlings. Therefore, until they get into the way of it, close supervision is necessary. If, however, the seed-beds are grown as above described, the seedlings are themselves sturdy and are easily separated one from the other and not so much difficulty will be felt. As regards the distance apart at which seedlings should be transplanted the ryot should use his own judgment. On land which produces over 750 Madras measures per acre ¾ths of a span, and on land which produces 500 Madras measures or less half span will probably be the best distances. Occasionally on very rich land which may normally yield 1,500 Madras measures of paddy even as much as two span distance between the seedlings may give better results, while on very poor land the cost of single planting may be prohibitive. Further than this the Department is unable to advise us; so much depends on the variety of paddy, the quality of the seedlings, and whether the seed has been selected from singly planted crops or not.

---

## THE INDIAN TEA INDUSTRY.

### THEIR POSSIBILITIES.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 9, September 1, 1909.)

Through the kindness of a friend, a copy of the journal of the Luskerpore Valley Society of Planters has been procured for perusal as advised by "Arboriculturist." The journal is for 1906. Whether this is the latest issue the writer is unable to say, but he is informed that there was no issue last year. The general get-up of the journal is good, and the society appears to have been thoroughly well conducted. Why such a desirable and useful institution should have been allowed to lapse, it is difficult to imagine. In its constitution its objects are clearly stated: "to form in the district a regularly constituted body of planters and others interested in tea culture, who may take cognisance of, discuss and take steps in regard to, any professional matters which possess general scientific interest, apart from the objects of the Indian Tea Association and its branches, and also by discussion, reading of papers and other means to further the dissemination of professional knowledge." All this is very laudable indeed, and it may be remarked in passing that the society will not have much difficulty in discussing matters of either scientific or practical interest, apart from the objects of the branches of the Indian Tea Association, the sole object of whose existence appears to be to call a meeting once a year and elect a committee which is never asked or expected to do anything.

The rules of the society number ten, the tenth being:—"There shall be no drinking during the meetings." This last rule has been the cause of no end of jokes amongst the wags of the other valleys, who have compared it to the printed notice hung over the piano in

the American cowboy's dancing saloon—"Don't shoot at the pianist, he is doing his best." Even a young assistant of the Luskerpore Valley is said to have declared that indulgences ought to be granted on special occasions, and that this rule should not be held as arbitrary when a particularly dull and prosy essay was to be read by a boss manager. Under the heading of "Minutes of meetings and discussions, papers and communications" we find interesting reading in the shape of various practical papers by members of the Association—"Unpruned Tea"; "The Annual Accounts of a Tea Estate"; "Manuring as a remedy for the deterioration of tea"; "Sorting and grading teas for the London market"; "Erection of Iron-framed buildings on Tea Estates," etc., etc. All these subjects are undoubtedly interesting to the planter, and when a number of planters join together and form a social club where they can meet periodically and discuss topics of common interest it will be found that a number of questions can be referred with advantage to expert authorities and the answers communicated in this way to a larger unmber than is now the case. It would keep planters in touch with each other and the scientific department of the Indian Tea Association to the mutual advantage of all.

According to "Arboriculturist" there would appear to be a want of knowledge generally amongst planters regarding arboriculture. Arboriculture is a very big subject, so big in fact that there is no one human brain capable of thoroughly grasping it in all its details and ramifications. It is even a greater and wider subject than agriculture itself. But, withal, the contention is that the tea-planter is a thorough arboriculturist in his own special line. He is a specialist and knows all there is to know at present regarding the special "arbor" which he grows and in which he is vitally interested. He has been taught and preached at for years by experts regarding the way he ought to treat his tea plant. Moreover, his Association is in possession of an experimental garden in charge of expert scientists. He probably will learn more as time goes on, and in twenty years hence, through the accumulation of knowledge and experience, he will know more than he does now. but that in no way detracts from the fact of his being an arboriculturist at present, and a specialist at that. The writer is still under the impression that the tea planter, taking him generally, knows more about arboriculture than he knows about the first principles of agriculture. For instance, there was only one paper read in 1906 to the Luskerpore Tea Planters' Society which touched upon agriculture, and that was "Manuring as a remedy for the deterioration of Tea." "Arboriculturist" said in his letter that if we consulted any of the back journals of the Luskerpore Tea Planters' Society we would see that the members had far passed the primary stages of agriculture.

If we may take extracts from this paper, which, as has been pointed out above, is the only one available, the conclusion must be arrived at that if the members of the Luskerpore Tea Planters' Society have passed the primary stages of agriculture, they must have passed over them. For instance, it is stated in the article referred to that "the nitrogen required for the plant is so small that this element is supplied more or less by the atmosphere and the rains"! Again, "Nitrogen is more a stimulant than a plant food"! Now nitrogen is the most important element of plant food and is the one most deficient in India. As stated in the article 10 maunds of tea remove 36 lbs. of nitrogen. But from all that is known we get no more than 5 lbs. annually per acre from the atmosphere and rain, and, according to long continued experiments carefully carried out, we lose this amount, at the very least, in drainage waters. The amount of combined nitrogen we receive from the air is derived from many sources. Lightning causes a little of the free nitrogen to combine, forming oxides of nitrogen. Fermenting organic substances give off ammonia which goes into the air. When fuel is burned, a small portion of the combined nitrogen is given off as ammonia in the smoke. Particles of organic matter are carried by the wind and some of these contain nitrogen. But, from all these sources combined, we receive at an average no more than 5 lbs. annually per acre. We might go on right through the paper in question and still further pull it to pieces, but we think enough has been shown to prove that the members of the Luskerpore Tea Planters' Society would do well to add some elementary books on agricultural chemistry and first principles of agriculture to their library. When a whole association of planters sit quietly and absorb such a statement as the above without a single dissentient voice, it is ample evidence that the audience is as ignorant of the subject as the author of the paper himself, and the only conclusion that we can come to is that, although they may have passed the primary stage they cannot have been well grounded in them, or they would not be floundering so lamen-

tably in the secondaries. But that is no reason why the Luskerpore Tea Planters' Society should be downhearted. The members can always console themselves with the fact that they are equally as far advanced as their neighbours.

"Arboriculturist" has said that one of the main objects of the society was to assist the young assistants in learning the outs and ins of things, or something to that effect. The longer paper read by one of the members on "Annual Tea Garden Accounts" will no doubt prove of special interest to them when they get money to speculate in tea garden shares. But we cannot help thinking that an equally lucid paper on the ordinary daily and monthly garden accounts of a tea garden would prove of more interest and immediate use to the assistants. It is notorious that a great many assistants could not tell you how the outturn on the garden on which they are employed compared with the dates of former years. There are assistants who know no more as to the rates or their working of the garden than the cooly who swings the kodali. Of course, this is not the case with large firms, but is too often the case in private gardens. It is difficult to see where the manager benefits by keeping his assistants completely in the dark regarding the garden accounts. The European assistant ought to be the manager's understudy in everything in connection with the management of the garden, whether it is in the office or on the *telah*. The writer has known of an assistant at the end of a three years' agreement who never had as much as seen a garden account or pucca cash-book all the time he had been on the garden, and, in fact, knew nothing more than an intelligent sirdar would be expected to know. Of course, there must always be private and confidential correspondence between the manager and the agents or proprietors. We do not allude to such, but to the books and accounts relating to garden works and expenditure thereon. As a tea garden proprietor, one would be inclined to look upon a manager with grave suspicion who kept his European assistants completely in the dark when, at the same time, his babus must be thoroughly in his confidence. It is the custom of some companies to insist upon the assistants becoming thoroughly acquainted with garden book-keeping immediately they arrive on the garden. Some assistants have it as part of their duty to check the accounts, and occasionally, if an assistant is found backward, he is made to copy and recopy them off until he is thoroughly proficient. Again, in some instances, the assistant is made equally responsible for their accuracy by his being made to sign them as well as the manager. It stands to reason that the more a man knows regarding his work the more interest he will take therein. Taking it all round, it is better for the assistant, better for the garden, as it is better for the managers, being in some cases the means of protecting him against himself, and, in a still greater number of cases, protecting him against his babus. There is no intention to belittle the importance of arboriculture in a wider sense than that of the tea garden, But at the risk of again offending, we would advise such study to be strictly ecological. There could be nothing more useful than a thorough knowlege of the different *jats* of timber in the neighbourhood of one's garden, and we think most planters are fairly well acquainted with such. As a body, we are very far behind in a scientific knowledge of our natural surroundings, but, when everything is taken into consideration, there are a great many excuses for us. It is well known that we have been described as a population of greasy mechanics, wind jammers, P. G.s and Pooh Bahs. A well-known planter has declared that this list might be added to by including Tinkers, Tailors, Bell-hangers and, to his very certain knowledge, there were a great many *sweeps* amongst us. The writer confesses to have been puzzled at the term "Pooh Bah." On inquiry, he has been informed that it means a man who has not had brains for anything else, and has been hustled out here to tea to get him out of the way. He, of course, seldom makes much of a tea planter, but he might do fairly well as a volunteer officer. Those who were too stupid even for this might get shoved into one or other of the Legislative Councils where, if they could do no good, they are not allowed to do any harm. They are like little boys, to be seen, not heard. When they are wanted to speak they are told to say, Aye, and upon some occasions they are ordered to say, No. After a few years of this they are figuratively patted on the head by being given a C. I. E. and retire with the firm conviction that they have been absolutely essential in building up the structure of the greatest Empire the world has ever seen.

---

## ON THE FERMENTATION OF CACAO.

By Fickendy.

(Amtsblatt f. d. Schutzgebeit Kamerun Jahrg., 1908, No. 17, Abstract in Centralblatt fur Bakteriologic etc. December, 1909. Translated.)

In the preparation of Cacao the author distinguishes between two distinct processes, on the one hand the fermentation of the pulp—the sweet slimy substance in which the beans lie embedded in the fruit—and on the other the changes which go on in the bean itself, and really have nothing to do with fermentation or are only indirectly related to this process.

The purpose of fermentation is mainly to kill the beans without destroying the enzyme. The proof of this is that the most important changes which appear after fermentation, in the form of the brown colouration of the nibs and the reduction of the bitter taste, are also produced without fermentation if the beans are killed under conditions which do not destroy the action of the enzyme, *e.g.*, by alcohol, by freezing or by grinding the beans to a pulp.

The production of a brown colour and the reduction of the bitter principle in Cacao are genuinely related processes. The bitter taste depends upon the presence of tannins, and the brown colour has its origin in the oxidation of these tannins. It is easy to prove that an Oxydase plays a part in the fermentation of Cacao. If the Cacao beans are heated in water to 75° C. and then ground the appearance of the brown colour and the loss of bitterness alike fail, whereas after heating for an hour to 70° C. the change of colour still takes place. The brown colour can still be produced in beans heated to 75° C. if a small quantity of watery extract of fresh Cacao beans is added. For comparison one may treat another portion of beans with a similar extract which has been previously heated to 80-100° and the change of colour fails to appear. A similar brown colour is produced in a pure solution of tannins by unheated Cacao-bean-extract, the discolouration commencing at the surface.

On the basis of these observations the following recommendations are made with regard to the practical treatment of Cacao.

(1.) In drying the temperature should not be allowed to rise above 60-70°.

(2.) When fermentation is completed the Cacao beans should be passed through a 5-10 per cent. solution of potash before drying. In this way a removal of acid from the Cacao is brought about which then encourages a further action of the enzyme and consequently a sweetening of the product. Cacao prepared in this way is also markedly more soluble and capable of suspension.

## PRICKLY PEAR: A PEST OR A FODDER PLANT?

BY A. J. EWART, D.SC., PH.D., F.L.S.,
Government Botanist and Professor of Botany in the Melbourne University.

(From the *Journal of the Department of Agriculture of Victoria*, Vol. VII., Part 9, September, 1909.)

As a variety of statements are current in regard to the value of prickly pear, some of which are highly misleading, it may, perhaps, be as well to give a short condensed account of the facts definitely known in regard to this plant, and to its nearest allies.

Firstly, to dispose of one popular myth, namely, that Luther Burbank was the first to develop a spineless form of cactus. The term "prickly pear" includes various species of *Opuntia*, some of which have been spineless or nearly so for ages, while even the most thorny forms occasionally develop nearly spineless shoots, which when separately propagated may retain the same peculiarity. In a condition of nature, however, these thornless sports either revert to the thorny condition or tend to be eaten out by stock, the thorniest individuals surviving. Under suitable conditions, however, or when protected in some other way, thornless forms may survive, and a few species in certain *genera* of Cacti, never appear to have developed thorns. Both at the Sydney and Melbourne Botanical Gardens, thornless varieties of the common *Opuntia* have long been known, so that at the present day it is impossible for any single person to claim the sole credit of developing a spineless Cactus (*Opuntia*).

A much more important misstatement is prevalent as to the value of the Cactus as fodder, some having even gone so far as to advise farmers to cultivate this noxious pest, to provide fodder for stock. Spiny Cacti can only be used as fodder after special treatment to destroy the spines and spinules or to render them soft and harmless. It has been stated that farmers, in the dry southern districts of the United States, burn off the spines with the aid of a torch and so render the plant available as fodder for stock. This may be of some use in times of drought, where farmers have not provided themselves with stored fodder, but except where abundant supplies of cheap labour are available, it would be a very expensive way of permanently feeding stock. Cacti are exceedingly watery, very poor

in nitrogenous (proteid) food, and by themselves would need to be eaten in almost impossible quantities to maintain stock in good condition. The best comment upon the supposed high value placed on prickly cactus in the United States, is afforded by the following extract from the *Farmers' Bulletin*, No. 72, of the U.S.A. Department of Agriculture:—

"Hundreds of square miles of the richest grazing country in Southern Texas, U.S.A., have been overrun with prickly pear, and the growth is each year becoming more impenetrable. In many of the southern countries it has been estimated that this cactus has already decreased the carrying capacity of the ranches one-fourth to one-third. The prickly pear is indeed a curse to the stock country. Some years ago, before cotton-seed hulls and meal were available as a fattening food, the pear was quite largely used after the spines had been disposed of, by roasting or boiling. Now, the cheaper and better cotton-seed hulls, which do not require a like amount of labour in their preparation, have almost entirely displaced it as a forage. The fruits are produced in great abundance, and when ripe are eaten with evident relish by birds, hogs, and cattle, and the seeds are thereby being very rapidly disseminated over whatever country is still free from it. Not only does the pear increase from the seed, but if a joint of the stem is broken off and falls on the ground, it takes root and produces a new plant.

"As a result of this rapid increase of prickly pear, the grass is being eaten to the roots wherever stock can get at it between the clumps of cactus. Paths are worn and the ground is trampled and packed, and the only grasses that are allowed to ripen seed, are those growing within these thorny citadels of cactus plants. Cattle on the range will not eat prickly pear unless driven to it by hunger or thirst. It is a better substitute for water than for food, but with this statement of fact the best has been said concerning the forage possibilities of this plant. It is a fact that it is spreading every year over a wider extent of range country, and that its presence in any considerable quantity is, on the whole, detrimental to the best interests of stockmen."

In New South Wales, the plant has sometimes been used as a supplementary fodder after prolonged boiling or treating with superheated steam, so as to soften the spines. Here, again, it must be remembered that the bulk of the plant in regard to its food value is considerable, and that the cost of treatment is proportionately great. Where no other green feed is available it may pay to use a portion of the growth covering the land, in this way, but it will not pay to cultivate it for this purpose.

In South Africa, the select committee appointed by the Legislative Council of Cape Colony, reported in 1890, that the prickly pear had spread to an alarming extent, especially on good land, depreciating the value of the land in certain districts by as much as 50 per cent.

As the result of many tests, spraying with arsenite of soda (1 lb. to 5 gallons of water) to destroy the plant has been recommended, but to make the spraying fully effective, the plants should be previously punctured on all sides with a fork, so that the poison obtains free entry.

During my recent visit to Sydney, Mr. Maiden arranged for a demonstration of a new method of destroying prickly pear which its inventor was supposed to have used successfully in Queensland, but which was merely based on the above principle of puncturing the stem to admit poison. Even assuming that the treatment as shown was fully effective, its cost worked out to over £4,000 per square mile, or £7 an acre, which is more than most of the land affected by prickly pear is worth, when cleared. The use of a heavy roller has been recommended, but grubbing out, piling, spraying the heaps, and burning when dry is the only method of permanently clearing. Even then the land is readily re-infected by seed carried by birds, etc.

The spiny cactus was originally introduced by Governor Philip in 1789, apparently for the purpose of starting the cochineal industry in New South Wales, but had not long been cultivated, before it ran wild, and became the terrible pest it now is in Queensland and in New South Wales north of the Hawkesbury River.

The fruits of the prickly pear are used as food for man in Sicily, North Africa, and some parts of the United States, the prickles being removed by rubbing with a cloth. They contain up to 14 per cent. of sugar, but barely more than ½ per cent. of nitrogenous food, so that they are comparable as regards food value, with sugary fruits like apples or pears, have a less food value than a potato, but rather more than a carrot or fodder beet. According to Wolff, 3 pounds of prickly pear fruits are equal to 1 pound of good dry hay. This applies only to the fruits of the prickly

pear; those of the spineless forms, which also grow in North Africa (Tunis, etc.) and probably contain less sugar, do not appear to be used by the natives as food. Further, the collection of the fruits is exceedingly unpleasant work, and the cost of collecting them in quantity as food for stock would be quite considerable. The same objection would apply to their suggested use for distillation purposes, while the vegtative parts are too bulky in regard to the small amount of fermentable carbo-hydrate they contain, to make it profitable to use them for this or any similar purpose.

### SPINELESS CACTI.

According to reliable information, some of the spineless cacti sold by Burbank have been privately imported into Victoria with the intention of encouraging farmers to plant them as fodder for cattle. It is not likely that any forms of cactus will thrive to such an extent as to become pests in the colder and wetter regions of Victoria, but this might be the case in the drier and warmer North-Western districts. It must be remembered that there is always a possibility of the spineless forms reverting, when wild, to the spiny condition. Apart from this, the fodder value, even of the spineless forms of cactus, is not very great. They are more stores of water than of food. In addition, they contain a certain amount of tough fibre, which has been known to cause impaction in stock grazing upon them, and which is only softened by prolonged boiling. The usual effect of such watery food is, however, to cause scouring, and this, coupled with the tendency of the plants to become acid during the night-time, prevents stock from fattening when fed exclusively upon them. Pigs will chew spineless cacti and reject the fibre, and stock in general take it rather as a source of water than of food, although cows will swallow it like other food. As far as the evidence goes, therefore, it is not possible at present to recommend the cultivation of the spineless forms of cacti, and in fact, the farmer who encourages the development on his land of any form of cactus at present definitely known to science will be ill advised.

The common prickly cactus is proclaimed for the whole State. If Burbank's spineless cacti are varieties of this species (*Opuntia monacantha*) they are also proclaimed, and it would be illegal to spread or propagate them in Victoria. There does not, at present, appear to be any reason for relaxing the proclamation in regard to the spineless varieties and, until more is known about them, it would not be safe to do so.

---

## INDIAN CORN AS A SUGAR PRODUCER.

(From the *Louisiana Planter and Sugar Manufacturer*, Vol. XLII., No. 8, February, 1909.)

The present movement in the direction of conservation of the natural resources of the country and the appointment of a national commission to act in concert with the executive department of the Government, state and national, has raised unusual interest, so says our old friend Prof. F. L. Stewart of Murrysville, Pa., who for many years has been engaged more or less in his propaganda urging the utilisation of Indian corn as a sugar-producing plant. In this interest he has recently issued an open letter to all concerned, showing that here in America we are wasteful of our natural advantages, and further, that we are wasteful of some of the acquired advantages which are the result of the natural fertility of our soils and of our climate for the production of certain plants. Prof. Stewart adverts to the fact that although Indian corn has been cultivated nearly all over the world since its discovery by Columbus in this country over four hundred years ago, the plant has not yet been nearly utilised in any proper measure. It has been found by analysis and by actual experiment in stock feeding that the stalks of Indian corn can be shredded into a hay-like mass which is digestible by animals as hay is, and is worth pound for pound as much as good average hay. Even corn cobs, when carefully ground are found to be digestible by animals to a very considerable extent, and hence valuable as a food stuff, and more particularly in combination with the rest of the corn plant.

Prof. Stewart, however, desires to call the attention of the American people to the fact that the corn plant is a plastic one and can be so cultivated as to have a value very similar to that of sugar cane. This can be done by the removal of the immature ear of corn from the stalk at the proper time. The direst result of this is an indefinite prolongation of the life of the plant and gradually by constant accumulation of sugar until it reaches a point where it equals the average in sugar cane and the sugar beet. Coincident with this in the secondary result and equally interesting and important is the fact that

there is very little of the hard, silicious coating when so cultivated as compared with the hard coat of corn cultivated in the ordinary way. Because of this the whole substance of the corn stalk is resolvable into pulp and cellulose, which is said to be of the finest quality for paper and for all the higher uses in the arts, for which cotton cellulose is now employed. The residue of field and factory products may be utilized to great advantage for the production of pulp, likewise for denatured alcohol and cattle foods.

It is stated that the stalk of maize when so cultivated will contain 88 per cent. of juice, of average sugar or sucrose content of 13 per cent., yielding 180 to 200 pounds of sucrose to the short ton. From the plant there will also be an average yield of 200 pounds of refined pulp, or cellulose. The green ears including the husks and foot stalks of the ear contain about 20 per cent. of their weight in fermentable matter, readily convertible into about half its weight of about 95 per cent. alcohol, leaving a residue of about 15 per cent. of pulp and about half that amount of richly albuminous foodstuff.

Prof. Stewart has been experimenting along these lines for many years, and claims now that the work has passed beyond the experimental stage, that it is of national importance and should be looked for as one of our natural resources that are now commanding in so great a degree the attention of the American people. The production of a valuable staple crop such as sugar, of a vast amount of paper stock, which is now lost entirely to the commerce of the world is worthy of consideration and attention, and he believes that the movement now being inaugurated by the national Government will result anyway greatly to the advantage of the American people, and all the more so if this one particular subject be taken into consideration and its merits be investigated.

# TIMBERS.

## WOOD-PRESERVING PROCESSES IN GERMANY AND FRANCE.

(From the *Indian Trade Journal*, Vol. XIV., No. 181, September 16, 1909.)

Various methods of applying preservatives to railroad ties and telegraph poles, says the *Journal* of the Royal Society of Arts, have been in practical use in Europe for more than twenty years. It would be difficult to find in any advanced European State a single railway, telegraph, or telephone line the ties and poles of which have not been impregnated with an antiseptic composition. Figures are published relating to twenty German telegraphic lines, the impregnated poles of which were set at various intervals from 1877 to 1893. Of those set in 1877 about 35 per cent. were still sound and in use after twenty-six years' service, and of those set from 1891 to 1893 there are records of five lines upon which all the poles are still standing. The American Consul-General at Hamburg says that the Bavarian postal service, after thirty years' experience, certifies that the known average life of impregnated poles in Bavaria is seventeen years and a half, and the German Imperial Adminstration calculated, in 1903, that the known average life of such poles was about sixteen years. In the meantime the work of impregnation is being more perfectly performed, so that future statistics will show better results. In France, the Eastern Railway Company announced, in 1889, that in the twenty-four years preceding 67 per cent. of its untreated oak ties had been replaced, while only 16 per cent. of such as had been treated with creosote had been removed. Beech ties properly impregnated, according to the chief engineer of that railway, have an average life of thirty-five years. More recent conclusions reached in the same system were to the effect that 80 per cent. of creosoted beech ties were good after twenty-seven years of service, while only 54 per cent. of oak ties treated in exactly the same manner were good after twenty-four years of service. The results of impregnation appear so conclusive and undisputed that it would be futile, says the Consul, to present further details on the subjects. In recent years the most useful preservative agents in use have been chloride of zinc, creosote, and bichloride of mercury, applied by imbibition, or by impregnation by injection forced by the pressure of the air. This second method of treatment generally consists in placing the wood in closed metallic recipients from which the air is pumped, and the liquid then introduced under high pressure. Until compratively

recently, it was very common to treat wood by injection under pressure of chloride of zinc, diluted with water. While this antiseptic is efficacious, it loses its qualities and becomes hygroscopic. To overcome these disadvantages, creosote was added to the mixture, and under the title of "mixed impregnation" this system has been adopted for the treatment of white wood ties which are too cheap to warrant the use of creosote alone. Hard wood ties, on the other hand, are impregnated with creosote alone; the general effect of which is to close the pores, coagulate the sap, and kill the micro-organisms in the wood. The use of creosote alone is quite unusual in the treatment of telegraph and telephone poles, because of the odour, tendency to melt and run under the sun, and objection raised by the men employed to deal with them. It is common therefore to use bichloride of mercury (the French Government use sulphate of copper), the efficacy of which has been known since the middle ages, when it was used to arrest decay and the action of insects. At the Himmelsbach plant, near Freiburg, this is used in 66 per cent. solution. The wood is plunged into timber or cement receptacles, and there remains from ten to fifteen days. In this plant, moreover, treated poles are given a special coating of some unknown antisepetic, which extends about two feet above, and two feet below the point where the pole enters the soil. This application protects the part where the variations in humidity commonly attack the pole. In the Himmelsbach establishment, there are tanks for impregnating forty ties at a time, under pressure; these tanks being about sixty-five feet long, and over six feet in daimeter. Their baths for treating telegraph poles are ninety-eight feet in length.

# PLANT SANITATION.

## ENTOMOLOGICAL NOTES.

BY E. ERNEST GREEN,
Government Entomologist.

The following notes are extracted from my Journal for the last three months (October 15 to January 15), and may serve as a record of the insect pests of that period.

Another occurrence of 'root gall-worm,' on tea seedlings has been reported from the Lindula district (where it was associated with a similar infestation of Albizzia seedlings). Though this Nematode is fatal to young plants, it does not appear to affect older and well-established tea bushes, in which the root system has attained a depth beyond the reach of this pest. In the nursery in question, a certain number of the plants had made good growth and had developed sound taproots. The question arose as to whether it would be safe to put out these healthier plants, or whether it would be advisable to destroy the whole nursery. Considering the apparent immunity of older bushes, and the fact that these healthier plants had already formed deep roots, I think that the latter might be safely utilized.

'Green Bug' (*Lecanium viride*) appears to be establishing itself upon tea on several estates in the Haputale district. Until quite recently, this once notorious pest of the coffee plant had shown no special partiality for tea; but this new departure will require attention. It can never obtain such a hold upon the tea bush as it did on the coffee, because it can be more readily checked at the periodic prunings. The destruction of prunings by fire, on all fields affected by this pest, should be enforced. The pruned bushes should then be sprayed with Kerosene Emulsion or with a soap solution. If the bug should reappear at a time when the bushes are not ready for pruning, the spraying should be repeated, but with soap solution alone.

Two further outbreaks of the Noctuid caterpillar (*Caradrina reclusa*) have occurred upon tea, in the Pussellawa and Kandy districts respectively. This pest is of rare occurrence and lasts—apparently—for a single generation only. It is doubtless held in check by natural enemies.

The usual and ever-recurrent tea pests have been reported from time to time. The 'Red-Slug' caterpillar (*Heterusia cingala*) has been received from several districts in the Central Province. 'Red Borer' (*Zeuzera coffeæ*) appears to be independent of times and seasons. 'Tea-Tortrix' (*Capua coffearia*) has attracted attention in the Dikoya and Pussellawa districts. 'Shot-hole Borer' has been recorded, for the first time, from the Maturata district.

*Helopeltis* has been seriously injuring the Cacao on the Experiment Station,

Not content with puncturing the pods, it has been killing back the young shoots, with the result that the affected plants have made no new growth and present a very miserable appearance. In the case of young plants (supplies), great improvement has resulted from shading them with palm fronds. It has been decided to spray the older trees with 'Imperial Bar' Soap Solution, which has been recently used with success against this pest on tea gardens in Assam. The plots of Nicaragua Cacao are the principal sufferers from Helopeltis, and many trees have succumbed to the combined attacks of this pest and of 'Brown Borer' (*Arbela quadrinotata*).

A study has been made of the insects that normally breed in Cacao pods. Some living but more or less diseased pods were collected from the trees and placed in a close-fitting cage (to prevent contamination from extraneous sources). A surprising number and variety of insects has emerged from them, all of which must have originated in the pods while still on the living tree. It is not to be supposed that they are all actively injurious to the fruit. Many of the Diptera (which have appeared in enormous numbers) are probably attracted by decay originated by one of the several pod fungi. Minute Mycetophyllid flies have been bred out in thousands and have continued to reproduce themselves in the decaying pods for many weeks. Their larvæ are worm-like, but exhibit a distinct head. A small black species of Chlorodid fly appeared in considerable quantities. I have not been able to determine the larvæ of this species; but it belongs to a family of which the larvæ may be actively injurious (such as the leaf and stem miners) or may breed in decaying vegetable matter. Several Tachinid flies that made their appearance may be looked upon as friends, for their larvæ live parasitically in other living insects. The collection of pods has produced two different kinds of beetles:—a Longicorn (*Pterolophia annulata*), the larvæ of which tunnel in the living pods and incidentally afford a passage for other forms of decay; and a small Anthribiid (*Araeocerus* sp.), the members of which family habitually breed in seeds and other dry vegetable products. But the most unexpected occurrence has been the appearance of a small 'Clearwing' moth (*Sesia flavicaudata*) which has hitherto been considered by collectors as quite a rarity. The emergence of a considerable number of these moths from a comparatively small number of pods—picked haphazard from the trees, proves that this species must breed habitually—as a borer—in cacao fruits.

Other insects associated with cacao that have been noted within this period are:—Caterpillars of *Eupterote geminata* and *Belippa laleana*, and two species of Weevils (*Episomus lacerta* and *Myllocerus* sp.), feeding upon the young foliage.

The "Gardeners' Chronicle" of Dec. 25, 1909, has a short note on Prof. Newstead's recent visit to the West Indies, in which it is stated that "Mr. Newstead found on plants of *Hevea brasiliensis* a night-feeding slug which no one had previously detected, although the damage it occasioned was considerable." A girdle of cotton wool around the stem is recommended as a simple yet effectual remedy. It would be interesting to know if this West Indian slug is the same species (*Mariaella dussumierii*) that has caused similar trouble in Ceylon, (see *T.A.*, Nov. 09, p. 43d). The cotton wool barrier may be effective during dry weather (when the slugs are not active, with us), but would be quite useless during the monsoon rains.

The following extract from the "Album do Estado do Para," quoted in the "India Rubber Journal" of October 10, 1909, looks as if the Brazilians are growing alarmed at the rapid extension of rubber cultivation in the East, and are trying to comfort themselves by exaggerating the severity of the pests against which we have to contend. The "Album" remarks that:—"The highest price obtained by Ceylon india-rubber does not compensate for the heavy losses which that Island suffers from the decay of its trees through the all-devouring 'Capin' (white-ant) and the defective nature of the soil." As regards loss through the ravages of termites, this statement is absolutely untrue. I do not believe that a single rubber tree in Ceylon has been killed by white-ants. It is true that the stumps of dead or dying trees are sometimes found to have been attacked by these insects; but, in every case that has been submitted to examination, it has been demonstrated that the tree had been previously attacked by a fungus disease. These diseases, of course, lead to a certain loss, but the deaths from this cause amount to but a very small percentage on the number of healthy trees. I do not think that our "defective soil" requires any elaborate defence. It is admittedly not so rich as that of the virgin forests of Brazil; but it has proved itself capable of raising rubber trees yielding from 200

to 1,000 pounds of dry rubber per acre, which is good enough for most rubber planters.

I have recently found examples of the 'Shot-hole Borer' (*Xyleborus fornicatus*) in cankered branches of Hevea rubber. The pest was prevalent in the surrounding tea and had found a suitable nidus in the diseased rubber branches in which there was no latex. This occurrence need cause no alarm. A healthy rubber tree is amply protected from boring insects. In this particular case, it was interesting to observe that several of the beetles, having ventured upon operations too close to the healthy area, had been entrapped in the consequent flow of latex.

Another extremely interesting occurrence was the discovery of numerous minute Staphylinid beetles in the galleries of the borer. These beetles are known to be carnivorous and predatory. The presumption is that they were preying upon the defenceless grubs of the borer. This discovery was considered of such importance that a special visit was made to the estate to ascertain whether the friendly Staphylinids were frequenting the galleries of the borer in the neighbouring tea. But in this hope I was disappointed. Still, the fact of their association with the borer even in the limited area of a diseased rubber branch is encouraging. Having discovered the edible properties of the larvæ in one situation, they may possibly extend their range.

The leaves and young stems of Hevea rubber are very frequently infested by 'Black Bug' (*Lecanium nigrum*). The older trees do not appear to suffer from the pest—to any great extent; but when the insect occurs thickly on small plants, it checks their growth. Such plants should be washed with MacDougall's Solution. The older scales may first be crushed by hand.

'Brown Borer' (*Arbela quadrinotata*) has been observed on Para rubber, in the Ruanwella district. In this instance, it had evidently strayed from the Albizzia trees growing amongst the rubber. The borer makes its entrance at the angle of a branch or in the fork between two stems. When observed, the hole should be plugged with tow soaked in coal tar. I do not think that there is much likelihood of serious trouble from this pest.

I have received, from the Passara district, a branch of Hevea from which were suspended numerous cases of the 'Bag-worm' (*Psyche vitrea*). This insect occurs commonly upon the tea, and it is



probable that these individuals had ascended the rubber tree solely for the purpose of pupation. There were no signs of defoliation of the rubber.

'Kikxia' (*Funtumia elastica*) trees, on the Experiment Station, have been completely defoliated by caterpillars of the Pyralid moth (*Caprinia conchylalis*). This pest constantly occurs in the months of December and January, and has resisted all attempts at treatment. At the commencement of the present attack, the trees were thoroughly sprayed with Lead Arsenate, but without any beneficial result. The caterpillar appears to be restricted to a very limited range of food-plants and is consequently unlikely to become a general pest. The only plant--other than *Funtumia*—upon which I have seen it feeding is *Portlandia grandiflora* (a shrub imported from Jamaica). It must, however, have some native food-plant, as the insect occurs only in the Indian region. It refuses to feed (even under pressure of starvation) upon the leaves of either Hevea or tea.

The caterpillars of *Lymantria Ampla* and *Psyche albipes* have been found feeding upon the foliage of *Manihot dichotoma*. The females of both these moths are wingless and lay their eggs in a mass in one spot. The resulting larvæ would naturally spread themselves over the plant upon which the eggs had been deposited, and might occasion serious defoliation. The advantage of destroying the original caterpillars is obvious.

I have received, through Messrs. Freudenberg & Co., specimens of a scale-insect that is reported to be destructive to Coconut Palms in the South Sea Islands. I at first believed it to be a new and undescribed species, but I now find that it has quite recently been described by Dr. Lindinger, of Hamburg, under the name of *Furcaspis oceanica*. It covers the surface of the palm fronds with a mass of small circular reddish-brown scales. Though the first report designates the pest as a menace to coconut cultivation in the Caroline Islands, Dr. Lindinger writes me that—in his opinion—the part played by the insect has been exaggerated, and that the injury to the young palms is more truly attributable to excessive drought.

A corner of the rice field, on the Experiment Station, has been badly attacked by caterpillars of a Pyralid moth (*Marasmia bilinealis*). I do not know of any previous record of this insect as a rice pest. The attack is confined to three or four plots at one end of the field. These particular plots

were treated with green manure, before sowing, and had produced a very rank dark green growth in marked contrast to the golden green of the rice plants in the remainder of the field. The caterpillar is of a leaf-green colour, and of the normal form of such leaf-rolling larvæ. Its *modus operandi* is to turn up the edges of the leaves and stitch them together with bands of white silk, at intervals of about half an inch, along the greater part of their length, forming a long tubular retreat within which it feeds upon the tissues of the upper surface, leaving only the lower cuticle intact. This lower cuticle dies and bleaches to a dead white. It finally transforms itself into a small reddish pupa, in a covering of white silk, within the folded leaf. The moth is extremely abundant in grass ravines and probably feeds upon various grasses. It seems possible that the cuticle of the rice plant is normally too hard for its purpose, but that the rank growth induced by fertilizers has altered the texture of the foliage.

In the *Tropical Agriculturist* of November, 1909, I reported a case in which 'Shot-hole Borer' had been discovered in cankered branches of *Albizzia moluccana.* I have now to record a case in which otherwise healthy branches of the same tree have been riddled by the borer. I have hitherto found that Albizzias—in good health—have been able to resist infection. But I can find no signs of disease in the branches now sent to me. The bark is of a healthy green colour and is full of sap, showing that the trees must have been in vigorous growth, yet they are riddled from end to end. The galleries of the insect contain larvæ and pupæ in all stages of development. On the estate in question, the tea is infested with 'shot-hole' and the prunings are being systematically burnt. The Albizzias are growing amongst the tea and are being lopped to supply a green manure. It is in these lopped branches that the borer has been discovered. The Superintendent writes:—"All the expense incurred in burning prunings and manuring again before its time bids fair to be of no avail. I fancy, after my pruning and burning, the few surviving borers must have taken refuge in the Albizzias and, being apparently prolific, are well on their way to infect this field again seriously. I am burning the stripped Albizzia branches now, instead of laying them in the rows." This is a serious matter and—if of common occurrence—will render *Albizzia moluccana* an unsuitable tree for such cultivation, at any rate, in 'shot-hole' infested districts.

The same tree is subject to attack by a boring caterpillar (*Arbela quadrinotata*). A report from an estate in the Ruanwella district states that these caterpillars (the 'Brown Borer') were attacking Albizzia trees in hundreds, and were found in the very heart of the trees, many of which had died out. This is an unusual sequence of events. The borer feeds upon the outer bark only of the tree, and usually makes a tunnel—down some knot-hole—merely as a retreat. It is possible that the death of the trees may have been due to some other cause.

Two pests affecting Albizzia seedlings have been reported. A nursery in the Ratnapura district has been extensively defoliated by caterpillars of the Noctuid moth (*Polydesma inangulata*). The second case is of more importance. It was observed that the young plants hung back unaccountably. Examination of the roots showed that they were badly infested by the Root Gall-worm (*Heterodera radicicola*). This necessitated the complete destruction of the nursery.

'Dadap' (*Erythrina lithosperma*) trees are subject to the attacks of a small boring caterpillar (*Terastia meticulosalis*) that tunnels in the ends of the green shoots. The pest may seriously check the growth of young plants and—in such cases—the affected shoots should be cut off and destroyed. But in older plants the injury is of little importance. The borer confines its work to the sappy ends of the branches, and the tunnels do not penetrate very far. Where Dadaps are grown for manurial purposes, the presence of the insect may even be advantageous as—by stopping back the ends of the branches—it induces them to bush out along the sides.

Eucalyptus trees, at Bandarawella, have been attacked by a minute Chrysomelid beetle—one of the hopping species (Flea-beetles). The insects feed upon the undersurface of the young leaves and cause considerable disfigurement of the foliage.

A correspondent of the "Times of Ceylon" wrote, under date November 18th, to warn planters against encouraging *Passiflora fœtida* on estates, and asks "if estate managers are aware that snakes feed on the fruits of the passiflora." He is consequently afraid that the cultivation of this plant "would increase the number of poisonous snakes.'

I have never heard of a frugivorous snake. It must be of a species quite new to science. All known snakes are carnivorous. Possibly an explanation of the statement may be found in the fact that rats are fond of passion fruit, and that many snakes have a partiality for rats,

Ornamental Ribbon-grass, in Colombo, has been attacked by a species of 'army-worm' (*Leucania exempta*). If this pest should give serious trouble, it may be checked by laying down poisoned baits, or by the use of Vaporite.

The caterpillar of *Lenodora vittata* has been found feeding upon the foliage of sugar-cane in the Peradeniya Gardens.

An attempt has been made to prepare Kerosene Emulsion by the new formula, in which the oil is emulsified with Bordeaux Mixture instead of with soap. This is the formula evolved at the Woburn Experimental Fruit Farm. The mixture was not successful, owing to the poor quality of the local Kerosene. In the Woburn experiments, Solar Distillate was employed.

---

## MISCELLANEA: CHIEFLY PATHOLOGICAL.

By T. Petch, B.A., B.Sc.

As has been announced in the local press that Tea seed imported into Ceylon from India must now undergo a process of disinfection unless it is certified to be the product of a district which is not infected with "Blister Blight." This disease has been known to occur in Northern India for many years, but since 1906 it has become increasingly serious, and, according to private advices, it is extending its range. Despite assertions to the contrary, it has never been recorded for Ceylon; and it is improbable that a disease which is distinguished "by the completeness of the destruction which it causes during the short time which it lasts" would have escaped the notice of tea planters. Under these circumstances it was considered advisable to take steps to prevent its introduction into the country. This is more especially necessary at the present time, since large quantities of seed are now being imported for extensions in tea planting. The disease in its most characteristic form causes raised white circular blisters on the *under* surface of the leaf; corresponding with the white blister on the under surface, there is a bright green circular pit on the upper surface. Sometimes these conditions are reversed. The white surface, when seen through a lense, has a floury or mealy appearance, due to the spores which are formed on it. It has been stated that the fungus (*Exobasidium vexans*) which causes the disease has been found also on the garden Croton (*Codiaeum variegatum*) and on the "Na" tree (*Mesua ferrea*), but from mycological considerations this is improbable. As with the similar reports of the occurrence of Grey Blight on jungle trees in Ceylon, these statements are based only on a superficial resemblance of the leaf spots and not on an examination of the fungi which cause them. The disease is spread by the spores, which are blown off the blisters by the wind; it is highly probable, therefore, that the tea seeds from an infected estate would have some spores adhering to them. We do not know, however, how long the spores retain their power of germination, and, of course, no experiments in this direction are possible in Ceylon. The disinfection of seeds in order to prevent the introduction of fungus diseases is not a new idea, though it has never been previously attempted in Ceylon; in the West Indies, cotton seed is always disinfected with this object. As is well known, many countries have gone further than this, and have prohibited the importation of any seeds or plants from Ceylon, while others have confined their prohibition to particular products, in order to prevent the introduction of *Hemileia*, *Thielaviopsis*, etc.

---

The destruction of Ceylon coffee by *Hemileia vastatrix* led to its total abandonment in the Island. Other countries, profiting no doubt by Ceylon experience, have been able, by adopting different methods of cultivation, to retain this product in spite of the attacks of leaf disease. In some of these countries the search for species which are immune or resistant to *Hemileia* has been consistently pursued for many years, without any striking success. Java at one time thought that the desired species has been found in *Coffea robusta*, but further experience has not justified that idea. Dr. F. C. von Faber, writing in the Tropenflanzer, states "*Coffea robusta* has been especially cultivated in Java, and does not appear to be very resistant to *Hemileia*. This plant is comparatively weak, and therefore suffers more than Liberian coffee when it is attacked. At Buitenzorg, this species is regularly attacked by *Hemileia*. The great expectations which were based on *Robusla* coffee do not appear to have been altogether realised.'

Other species are now being boomed, the chief of these being *Coffea congoensis*, but trials on a large scale for an extended period have yet to be undertaken. *Coffea robusta* is now being planted as a catch crop in rubber; it may yield a paying crop under such circumstances, but it is as well to remember that it is not exceptionally resistant to *Hemileia*.

---

From Costa Rica samples have been received of a coffee disease which does not appear to have been noticed in the Ceylon coffee days. The disease affects the beans only. The bushes on which the diseased beans are found are quite healthy, and the "cherry" does not show any indications which would lead one to suspect that the beans were unsound. But the beans are found to be blackened and disorganised, and such black beans have altogether lost their natural aroma. The cause of the disease does not appear to have been ascertained. One observer states that the mycelium of a fungus occurs in the blackened beans, but this is not regarded as definitely established, and the effect is thought to be due rather to physiological causes. The disease seems to have been known for a long time, but in recent years it has become more prevalent and in some cases has destroyed eighty per cent of the crop. I have not been able to find any record of it in Ceylon, but a coffee planter from Southern India informed me that it sometimes occurs there on the second crop.

---

During August, 1909, an extensive fall of leaf occurred on several of the older Hevea plantations in Ceylon. In the majority of cases the leaves were shed from the terminal shoots all over the crown of the tree, but a few trees became quite leafless. On one estate where the trees were exposed to the South-west wind, the leaf fall was greatest on the South-west side of the trees. In some respects this phenomenon resembles "dieback," but it differs from the latter disease in that bare shoots occur all over the crown and not only at the apex. The death of green shoots all over a tree may be a sign of overtapping or of root disease, but in the cases referred to the shoots were not dead, as a rule, and neither of these causes could be held responsible for the leaf fall. The leaf fall was normal, in so far that the leaves were cut off just as they are when the trees "winter," and no fungi could be found on the leaves or on branches from which the leaves were seen to fall. In a few cases, the terminal shoots died, but this was exceptional. The specimens sent in for examination consisted usually of dead branches bearing growths of saprophytic fungi which proved that they had been dead for some time; and it was found on examination of the trees that these branches were obtainable from the interior of the crown of affected trees. But dead branches occur quite normally in such a position; they are killed by the shade, or because they are weakened by being deprived of their food by stronger branches, and they have no connection with the leaf fall. A few dead trees were shown me, but in every case death was due to root disease, and the fungus (*Fomes semitostus*, etc.) was quite evident at the collar. Root disease was looked for in all cases but was only found on two or three trees; it is quite certain that the general leaf fall could not be attributed to this cause, and moreover the subsequent recovery of the trees negatives the idea.

A similar leaf fall occurred in 1903; and a comparison of the weather conditions in 1903 and 1909, together with the absence of any fungi on the fallen leaves or bare twigs and the subsequent recovery of the trees, leads to the conclusion that this is purely a climatic effect due to the prolonged rains of the South-west Monsoon. Trees grown on comparatively dry soils will lose their leaves and become "stagheaded" if the soil is waterlogged for any considerable time, because their roots are deprived of oxygen, and this appears to be the explanation of the present phenomenon. It was not confined to Hevea. On one estate, defoliation occurred in the case of jak trees as well as Hevea, and three cases of leaf fall in tea were reported.

It is of course a well-known fact that Hevea has been planted with marked success on swampy land. One such plantation, which was flooded every other week during the last South-west Monsoon rains, was visited, and it was found that no noticeable fall of leaf had occurred. This, however, is not at variance with the reason given above, for the trees in such situations develop an enormous number of feeding roots at the surface, so much so that one is at times walking over a spongy carpet of white rootlets; their roots can therefore obtain air even when the soil is waterlogged. This plantation, by the way, is the one about which the erroneous statement was made at the Rubber Exhibition of 1908, that the trees were planted in swampy land and soon died.

Further details of this leaf fall, and records of the rainfalls for the last six years, have been included in a circular

on "Dieback of Hevea" which is now in the press. The affected trees put out new leaves when the rains ceased, though in some cases their recovery was slower than was anticipated. Defoliation must to some extent check the growth of the tree, but beyond that there is no permanent injury.

# LIVE STOCK.

## IMPROVEMENT OF INDIAN CATTLE.

BY JUNGLEE,

(From the *Indian Agriculturist*, Vol. XXXIV., No. 11, November, 1909.)

There seems to be an awakening amongst the people of India as to the state of their cattle, and more attention is being paid to breeding. The people have, hitherto, especially in North-Eastern India, seemed too indifferent to take trouble over their cattle. Over abundance of fodder allows them to keep large herds of degenerate animals, which require little or no attention. These animals give a little milk, and just draw their ploughs. This suffices for the owners' wants, so why bother? These old ideas, however, are slowly giving place to new, especially close to mofussil towns and where cultivation has covered the land, and large areas of grazing land are not available. The cultivating class have been forced to realise the value of good cattle. The Government with their Agricultural Department have helped to foster the spirit, and are doing a great deal to improve the cattle by importing animals from England, Australia, and also from the North-West, and the Punjab, into Bengal. These imported cattle no doubt help a great deal to improve the stock near the Government Depôts. But these animals are not suited to be distributed among distant villages, where large herds are grazed. What the Government want to get at are the villages right outside the highly cultivated parts where there are large areas of grazing with enormous herds being bred. It is from these distant tracts that the milk and plough cattle are drawn for the more thickly populated parts. In these cattle districts the highly bred-stall-fed beast would soon die of starvation and want of attention, besides imported cattle are more liable to local diseases, from which the local cattle are practically free. India, though generally poor in domesticated cattle, is the richest in the world in their wild congeners, having the buffalo and bison (Gaveous Garus and Frontalis), the Tsaing (Bos Soondacios) of Burma, besides sheep and goats in the higher ranges of the Himalayas. There are domesticated animals also that have gone wild; these are very much hardier and larger than the local domesticated animals. Such wild cattle are found at Nellore in Madras, and Baker mentions some on the Islands of the Megna and Brahmaputra.

The buffalo is indigenous to India, being found wild in the districts of Purnea, Malda, Dinajpur, parts of Assam, in the Nerbudda Valley, and Burma. The natives utilise the wild herds and breed their domesticated animals with the wild ones, the result being a magnificent, powerful animal, almost half as large again as the ordinary village buffalo. This is very noticeable in the Purnea district, where most of the buffaloes are either directly descended from the wild, or are half-bred. Along the Kosi and low lands by the Ganges near Manihar Ghat, there are large herds of these known as Arni—big grey animals 15 to 16 hands high with long powerful horns. Across the Ganges on the Sahebganj side the buffaloes are quite a contrast to those of the Arni, being the ordinary buffalo only 12 to 13 hands high and in no way as powerful. These Arni buffaloes are very much sought after for heavy work in sugar mills, etc. There is always a cry that India possesses no draught animals capable of drawing our English ploughs. These Arni buffaloes could equal an English horse, and though not as quick could easily drag an English plough. On wet marshy ground, such as is common in the Bengal paddy fields, they would indeed be superior to the horse. The same use is made by the people of Assam of the wild herds, and the animal produced is very powerful, though not as tall as the Purnea one,—thicker set with shorter and thicker horns, and black in colour. Of course, these are only available where there are wild herds, it being rather a dangerous game sometimes to get the tame cows away from the wild buffalo. A wild bull in defence of his herd cares neither for man nor beast and is a very dangerous customer to tackle. And at times the natives lose their cows for months, but they generally come back to their own herd. For improving the breed, there is, besides, these wild animals, the Bikaneer curled horned buffalo,

This seems more allied to the African species, and freely inter-breeds with the straight-horned Indian variety. As the buffalo is indigenous, the use of the wild buffalo for breeding should be taken up in a systematic way by the Government, and not left to the casual meeting of the wild and tame herds. Every effort should be made to preserve the latter which are becoming yearly smaller, and wilder, being driven into wilder parts, and Nepal. The destruction of these animals by villagers, during heavy floods, while the cows are in calf, or with very small calves, is a disgrace to any civilised nation! If measures are not taken to make sanctuaries for these splendid cattle, we will soon find, like the Americans with their bison that the animals will be practically extinct. Breeding depôts should be placed in all localities where wild buffalo herds now exist. Every effort should be made to, not only breed and domesticate the wild ones, but selected domesticated cow buffaloes should be brought from other districts to breed with the wild ones. To improve stock and prevent inter-breeding, the first young cows could be exchanged with those of another district's depôt, and the young half-bred bulls, from one district depôt could be sent to another district's villages to improve the domesticated herds, while the young half-bred cows could be bred back in still another depôt, making three-quarter bred animals and so on till they become practically pure wild stock domesticated. There should be sanctuaries for about 10 miles round each depôt for the wild buffalo, and no one should be allowed to shoot or molest these animals.

The bison (*Gaveous Frontalis* and *Mithan*), is already partially domesticated by the wild tribes of Assam, and is used largely for milk and flesh, though so far it has not been utilised to cultivate the land. This is another magnificent wild animal over 16 hands high, and even more powerful and thickset than the buffalo, which could be used in the same way as the buffalo for improving domestic stock and breeding.

We next come to the *Gaveous Gaurus Bison*, this is the king of all the Bos, the largest and the most symmetrically built bull in the world. It is said that the animal cannot be domesticated. If that be so, still the Government could easily wire in quietly large areas of forest and drive in herds and by degrees get them familiar with man, and use them for breeding. This animal is considered very shy, and pines away from the forest, so its domestication would be very much more difficult than any of the previous animals mentioned. But, no doubt, if persistent efforts were made to domesticate the bison it could be done, although it might take a few generations. The result would be worth the trouble. India would then have cattle 17 to 18 hands high, an enormous meat-producing animal, and one that would be worth his keep in a dairy. In Burma, there is the *Tsaing Bos Soondacious*, this is a similar animal to the bison. In many parts of Northern Burma the cattle look as if they originated from this stock. No doubt, this beast could be used to improve the domestic cattle there.

The yak (*Bos Grunniens*) is domesticated and is used for carrying stores, and for milk. This animal would only affect the higher elevations and would not be suitable to the plains of India.

Turning to sheep and goats, these, especially the sheep, are only to be found in the higher elevation, and if used to benefit the sheep generally in India could only be done by crossing with the low land ewes and sending the ewes back to the plains. With goats the same applies to most of the varieties, except the Nilgherry wild goat which inhabits elevations 4,000 to 6,000 feet. There is no doubt that India and its boundaries contain the finest sheep in the world. It would be a great shame if these splendid animals were exterminated. It behoves the Government carefully to look into the question of the domestic cattle and their wild congeners, and make efforts to preserve them, as these animals are not only rare, but are an asset that can be utilised at any time for the benefit of the agricultural classes. At some future time Indian wild cattle domesticated may be exported to renew the blood for inter-bred and effete cattle elsewhere.

# SCIENTIFIC AGRICULTURE.

## CULTIVATION AND FERTILITY.

(From the *Agricultural News*, Vol. VIII., No. 184, May 15, 1909.)

Thorough and judicious cultivation is essential for a soil to give its best results as a crop-producing medium. Providing a soil is well-drained, the more deeply it is cultivated, the more extensive is the area through which the plants can forage in search of food, and thus it is that improvement in tillage methods which result in deepening the soil and promoting nitrification, tend to have the same effect as applications of manure.

The advantages of a deep soil, as compared with a shallow soil, are obvious, and—expressed concisely—these may be said to consist in the fact that when land is ploughed to a depth of no more than 3 inches, the plants growing thereon have 3 inches of food, while when the land is ploughed 6 inches deep the land has access to 6 inches of food, and so on. The lower portions of the soil are not so rich in available plant food as the upper portions, but this may be remedied to a large extent by suitable cultivation, which results in admitting air, moisture, and heat, the necessary conditions under which fertility is developed.

It need hardly be pointed out, however, that any deliberate attempt to lower the line of division between the soil and subsoil by deeper ploughing should be carried out gradually and with caution, and the most judicious plan is to extend the operation over several years, *i.e.*, to plough just a little deeper each season than was done in the previous year. Many instances are on record in which the fertility of land remarkable for its crop-producing capacity has suffered enormously as the result of lowering the depth of ploughing 2 or 3 inches below the normal level in one season. This is because the surface soil containing the organisms which are responsible for the breaking down of plant food has been buried, and a heavy, raw, infertile subsoil brought to the top.

Another important point in connexion with the capacity of the soil to return large crops is its ability to retain moisture. This power is greatest when the land contains a good proprocion of humus, is well tilled, thoroughly pulverised, the subsoil firm, and the oil kept in the form of a loose mulch t the surface.

As the result of all these conditions, absorption of rain water takes place readily, and this is retained instead of rapidly drawing away. Water in a cultivated soil is held in the form of thin surface films enclosing each separate particle. It is obvious, therefore, that the more thoroughly the land is pulverised by cultivation, the greater will be the number of soil particles, and the greater the capacity of the land to retain moisture. The presence of humus increases this storage capacity and reduces evaporation. It has been estimated by agricultural physicists that a ton of humus will store over seven times as much moisture as a ton of sand, and further, that sand loses its water by evaporation from three to four times as rapidly as the humus. Clay soils store only about one-fourth as much moisture as humus, and lose it by evaporation about twice as rapidly.

## THE STERILISATION OF SOIL.

(From the *Gardeners' Chronicle*, Vol. XLVI, October 23, 1909.)

Ever since it began to be realised that the soil is the home of a great number of minute organisms—bacteria and fungi—as well as of larger organisms like infusoria and eelworms, there have not been wanting experiments in which attempts were made to grow plants in soil which had been deprived of these living agencies. The results, however, that have been reported have been contradictory and difficult of explanation, and when also of late years certain gardeners began to use sterilised soil on a practical scale there has been a similar conflict of evidence as to the value of the treatment. The gardener has tried soil sterilisation, nearly always by heat, for various reasons; in the first place, he hoped to get rid of the seeds of weeds and the spores of the mosses and liverworts which encrust the surface of seed-pans whenever germination is long delayed; again, he hoped to kill off the spores of certain fungoid diseases which harbour in the soil, and the eelworms and similar organisms which often do so much harm to cultures under glass. Any process of sterilisation by heat, involving the heating of the soil, either wet or dry, to the temperature of boiling water, must be expensive, but whether it may prove to be commercially profitable or not, it is only very recently that we have learnt what sort

of changes go on in the soil during the process and have arrived at some understanding of the reasons for contradictory results mentioned above.

The experimental investigation of the subject began with the discovery, in which several men shared, that soil which has been heated to the temperature of boiling water will grow larger crops than the same soil which has not been treated. In this country Russell and Darbishire carried out a long series of such experiments, and showed that the heated soil will produce double the yield of the untreated soil, and that the beneficial effect persists as far as four crops after the original heating. All the plants they tried were benefited, except the leguminous species, and all kinds of soils behaved in the same way. Moreover, not only did the gross weight of the crop increase, but on analysis it proved to be richer in such essentials of plant-food materials as nitrogen and phosphoric acid, so that the crop grown on the soil after heating actually contained about four times as much nitrogen as that grown upon the soil which had not been heated. Various explanations of the action were put forward, mostly depending upon changes which were supposed to have been set up in the bacterial flora of the soil; but Pickering, as the result of his experiments, suggested that in the main the action was due to the splitting up of the organic matter (humus) of the soil by heating. He showed that the germination of seeds is retarded in soil that has been heated, and that the retardation is greater the higher the temperature to which the heating is pushed; he also showed that the soil after heating actually contained more nitrogen compounds in a soluble state. Hence he concluded that the heating had split off from the humus soluble nitrogen compounds which are injurious to germination, but which later will serve as food for the growing plant. Pickering's results are undoubtedly correct, in that ammonia and other soluble nitrogen compounds are split off from the humus by the heating; but some work which has just been published by Russell and Hutchinson, of the Rothamsted Laboratory, shows that this is only part of the story, the increase in fertility of the heated soil being chiefly due to a rearrangement of the living organisms inhabiting the soil. In the first place, it can be shown that heating to the temperature of boiling water for ten hours or so does not sterilise the soil; certain groups of organisms are killed off entirely, but others which exist in the form of spores resist the heat, and as soon as the soil cools down again begin to develop and multiply with great rapidity. For example, the bacteria bringing about nitrification are wiped out entirely, but most of the other groups retain some representatives, especially that class which take the complex organic matter of the soil and break it down into ammonia and kindred compounds. In one of the Rothamsted arable soils used in the experiments the normal number of bacteria in the soil before treatment was about 5,000,000 per gramme; immediately after heating the number had fallen to 60 per gramme, but then followed a very rapid rise; in a fortnight the original 5,000,000 had been reached, and a month or five weeks afterwards the number had risen to 26,000,000 per gramme. Step by step with this increase in the number of bacteria in the soil came a similar increase in the rate of production ammonia, *i.e.*, of a soluble nitrogen compound on which the plant could feed. It was thus demonstrated that, in the soil that had been heated, the increased crop is due to the greater amount of ammonia which becomes available for the plant, and that this increase in the ammonia is brought about by the larger number of bacteria, chiefly splitters-off of ammonia, which get a footing in the soil. Various experiments, which need not here be detailed, also demonstrated that the increase in numbers of the bacteria is not due to any stimulus derived from the heating, but to the removal of some factor which is at work in ordinary soil keeping down the numbers of bacteria. This new and unknown factor turns out to be the presence in ordinary soil of large non-bacterial organisms like amœbæ and infusoria, which habitually feed upon the bacteria, and thus, by keeping their numbers down, establish a certain numerical equilibrium between themselves and the bacteria. These higher organisms are wholly destroyed by the heating or other sterilisation methods, whereas the bacteria are only partially exterminated and afterwards develop to a much greater extent than before, because they have the field to themselves. With this increase in the number of bacteria goes an increased production of soluble plant food from the insoluble reserves in the soil and a corresponding increase in crop. With certain differences these results are repeated when other methods of sterilising the soil are adopted; if, for example, the soil in a dry state is exposed for some hours to the vapour of chloroform, carbon bisulphide, toluene or other volatile antiseptic, there is a

similar rearrangement of the organisms of the soil and a similar increase in its fertility, though not so great a degree.

We are now in a position to sum up the changes which take place in soil when it is subjected to one of these so-called "sterilisation" processes :—

(1.) Seeds of weeds, mosses, liverworts, &c., are killed. Fungi and their spores are also destroyed. It is found, however, at Rothamsted that the soil is very susceptible to reinfection when it is afterwards exposed in pots. Occasionally it becomes covered with moulds, and the usual green algæ rapidly cover the surface with a mat.

(2.) The texture of heavy soils is distinctly improved.

(3.) The heating gives rise to substances, of which ammonia is probably the chief, harmful to germination. This harmful effect will be less marked if the soil is stored for a time after the heating.

(4.) All organisms of an order higher than bacteria are killed off; the soil, for example, is rendered clean of eelworms, at the same time certain organisms which normally limit the number of bacteria in the soil are destroyed.

(5.) Thus provided with a clear field, the ammonia-producing bacteria increase rapidly, and there is a correspondingly greater production of plant food from the soil and manure, followed by an increase of crop. Certain groups of bacteria are killed off, *e.g.*, those which convert ammonia into nitrates; hence plants which only take in their nitrogen as nitrates do not show increased growth on the sterilised soil; only those plants (actually the majority) which can utilise indifferently ammonia or nitrates are benefited. Even in their case it is possible to see that they are feeding upon ammonia and not upon the nitrates they obtain from normal soil, *e.g.*, the cereals are shorter in the straw than would be expected from the richness in nitrogen. Nor is it always possible to reinoculate the soil with the nitrification organisms, heat-sterlisation seeming to produce some substance which inhibits the nitrification bacteria.

Space does not permit of a discussion of the results of greenhouse practice with sterilised soils in the light of these conclusions, but they will be found to illuminate much that has been obscure and contradictory in the reports. At any rate, it is clear that it is impossible to lay down the law beforehand as to whether "sterilisation" of soil will or will not be beneficial in a particular case. Experiment alone can show which of the numerous factors will be involved. Similarly, though a number of applications to practice suggest themselves, it would be unwise to discuss them until more experimental work is forthcoming.

## THE EFFECT OF GRASS ON TREES.

By SPENCER PICKERING.

(From the *Gardeners' Chronicle*, Vol. XLVI., No. 1199, December, 1909.)

The effect of grass on trees is probably intimately connected with that fundamental question in agriculture to which no comprehensive answer has yet been obtained, namely, the fertility of the soil. The casual observer may dismiss the subject by stating that it is simply due to the grass robbing the tree of its nourishment or its moisture, but such a statement can only be based on ignorance of the facts, and of all the work which has been done in the matter. The subject has been under investigation at the Woburn Experimental Fruit Farm for the last 16 years; one report (the third) dealing with it was published in 1903, and it is hoped that another will be issued before very long.

Although no final solution of the problem has yet been obtained, considerable progress has been made in the matter, and various possible explanations have been definitely negatived. Foremost amongst these is the theory that the action is due to the grass absorbing all the food and water from the soil. The original experiments are, perhaps, the most striking, though not the most precise, on this point. A large number of apple trees were planted in rows, 11 feet apart, in 1904; the ground in one row was kept tilled, and that in the other row laid down to grass; the grass, when cut, is left to rot on the ground, and the same amount of manure is given to both rows of trees. Those in the tilled soils are now such large trees that half of them have had to be removed, their spread being some 15 to 18 feet; those in grass did not grow at all for several years, and only began to make growth when their roots extended beyond the grassed area; they are still miserable specimens of trees, about one-sixth the size of the others, and the crops borne by them have only been about one-tenth of that of their neighbours. Yet the grassed soil is actually richer than the tilled soil. In the fifteen years it has had removed from

it only one crop of grass (that actually growing at any given moment), and the small amount of material required for the stunted growth of the trees; whereas, from the tilled soil there has been removed material for an annual crop of fruit, and also for the vigorous growth of the trees. Analysis also shows that the grassed soil is the richer of the two, and it also shows that, in this particular case, there is practically no difference between the water contents of the grassed and open plots.

Of the many other experiments on these points, the most conclusive are, perhaps, those made with Apple trees grown in pots. In some of these the grass roots were separated from the tree roots by very fine wire gauze, through which the former could not penetrate; the pots were weighed and watered every two days, so as to keep the water contents the same, and such water and food as was added was introduced from below, so that the tree should have the first pull at it. Yet the trees still suffered badly from the grass, although the soil was actually moister and richer than in the case of similar trees without grass. Corresponding experiments have been made with trees planted in the open. Though increase of moisture up to a certain point and increase of food in certain cases may benefit the trees, the benefit is much too small to do more than very slightly diminish the deleterious effect of the grass.

The behaviour of a tree in grass is clearly a case of starvation in a land of plenty, and this cannot be explained by supposing (untenably as such a supposition is for other reasons) that the grass roots took up whatever nourishing solution there is in the soil, leaving none for the tree roots. The pot experiments, just quoted, effectively negative this. Nor can we explain the matter by supposing that the tree was only temporarily affected by the grass, but, being in a weak state after transplanting, this check resulted in its becoming permanently stunted; for a precisely similar, and even more marked effect has been proved to be produced by grassing over trees which have been established, in one case for four years, and in another case for twelve years; the effect, indeed, was so great that in the first instance, many of the trees have been killed, and, in the second instance, a similar result appears imminent.

Other explanations which suggested themselves have been investigated, and found equally unacceptable; these were differences in soil temperature, differences in aeration or proportion of carbon dioxide, and differences in the physical condition of the soil. The only other explanation which appears to be possible is that the growth of the grass results in the formation of some substance which is poisonous to the tree. This may be an active poison—a toxin—or the poisonous action may result from an alteration in the proportion of various substances present in the soil. An active poison may be produced in various ways, such as by the decomposition of the debris of the grass, actual excretion from the grass roots, or as a product of the bacteria present in the soil. As to the origin of the toxin, no definite evidence has yet been obtained, but it has been found that toxins may be formed in soils by heat, and other means, producing effects which are analogous in many respects with those produced by grass on trees. Thus, on heating soil, substances are produced which are toxic towards the germination of seeds, and these have been found to be toxic towards plant growth also. That established plants grow better on heated than in unheated soil, is due to the fact that heating causes a considerable increase in the soluble nitrogen present in the soil, and also in the composition of the bacterial flora of the soil. Moreover, the toxin formed as the result of heating the soil soon becomes oxidised and destroyed, allowing the favourable conditions to assert themselves. If, however, the toxin is present in sufficient quantity, it is not all destroyed before the plant grows, and its deleterious effect becomes apparent. It is noticeable that this effect varies greatly in difficult cases, and is very much less in the case of grasses than in that of the other plants which have been examined. Earth from grassed ground behaves in the same way as earth which has been slightly heated and which contains only a limited amount of toxic matter, for trees planted in it (the grass being removed) do better than in soil taken from tilled ground, such toxic matter as there was present in it having evidently become destroyed before the tree started into growth; whether its presence originally in soil can be established in its effect on germinating seeds, still remains to be seen.

If the formation of a toxic substance is the explanation of the grass effect, we might naturally expect great variations in this effect in different soils; and this is certainly the case. At Ridgmont the effect is, perhaps, greater than in any other instance which has come under the writer's observation, but cases of very nearly the same intensity have

been found in various parts of the kingdom, whilst only one instance has been noticed where the grass apparently had no effect. This variation in intensity with the nature of the soil is, probably, the chief reason why the action is not more widely recognised; but two other causes contribute to an under-estimation of the grass effect, the one that it is very rare for a plantation to be partly grassed in such a way as to give satisfactory evidence as to the bad effect of this grassing; the other, that the grassing is generally effected gradually, extending througout several seasons, and in that case, it has been found the effects are far less marked than they otherwise are, the trees, apparently, becoming gradually adapted to the altered conditions.

No definite connection has yet been found between the nature of the soil and the intensity of the action, but it does not appear to be governed by the richness of the soil. The case, alluded to above, in which the action has been nil, cannot be explained by any greater depth of soil into which the tree roots penetrate, thus getting away from the grass roots, for many of the trees have been lifted, and all have been found to have their roots near surface.

# MISCELLANEOUS.

## LITERATURE OF ECONOMIC BOTANY AND AGRICULTURE.

By J. C. Willis.

*Green manuring*:—

Leaf manuring in S. Canara. Couchman. Agri. Journal India 1908. "T.A." Nov. 1908, p. 461.

Green manuring. Ind. Agric. July 1908, p. 221. "T.A." Jan. 1909, p. 61.

Superphosphate and Basic Slag. Agri. News, VII, 173, Dec. 1908.

*Grevillea*:—

La gomme de Grevillea robusta. Journ. d' Agr. trop. 31. 8. 1908, p. 225. Abs. "T.A." Nov. 1908, p. 412.

*Groundnuts*:—

De cultuur der Aardnoten. Ind. Merc. 24. 12. 1898, p. 811.

Groundnuts as a profitable (?) investment. "T.A." June, 06, p. 373.

Peanuts or groundnuts. "T.A." Apr. 1906, p. 216.

Manipulation des Arachides aux Etats-unis. Journ. d' Agr. trop. 6, 1906, p. 358.

The groundnut. "T.A," Feb. 1907, p. 86.

Ground or pea-nut. Kew Bull. 1901, p. 175.

Groundnut cultivation in Burma. "T.A." Sept. 1907, p. 197.

L'arachide en Afrique occidentale française. Bull. Jard. Col. 1907, p. 186.

Groundnuts in Burma. Ind. Agric. Mar. 1908, p. 82.

Cultivation of groundnuts in Malabar. do. p. 83.

Notes on cultivation of groundnuts. Q. J. L'pool I. C. R. Jan. 1908, p. 30. "T.A." July 1908, p. 14.

The cultivation of groundnuts. Bull. Madras Dept. Agr. III. 58. 1908. "T.A." Jan. 1909, p. 22.

La culture de l'Arachide Aux Etats-Unis. Bull. Jard. Col. Nov. 1908, p. 422.

Uber Erdnus-Ausfuhr in Togo, Tropenpflanzer 13. No. 2. Feb. 1909, p. 81.

The Origin and Domestication of the Peanut or Groundnut (*Arachis Hypogœa*) in the United States. Trop. Life. Feb. 1908. "T.A." June 1909, p. 515.

Disease of groundnuts in Dominica. Agr. News, No. 194, p. 315, Oct. 1909.

Culture et composition de la Pistache ordinaire et de la Pistache Malgache. Mauritius Bull. No. 21, 1909.

Disease of ground nuts. Agr. News, VIII. 196, Oct. 1909, p. 374.

*Guava*:—

Guava jelly. Agr. News, 27. 6. 1908, p. 196. "T.A." Oct. 1908, p. 338.

*Guizotia*:—

Niger-seed oil, "T.A." Dec. 1905, p. 760,

*Gums*:—

The collection of gum in the Soudan. Trop. Life, Aug. 1907, p. 117.

La gomme de Grevillea robusta. Journ. d'Agr. trop. 31. 8. 1908, p. 225.

Uses, properties, and production of gums. Imp. Inst. Bull. 6. 1908, p. 29,

L' Exploitation du Copalier en Guinée. L' Agric. pratique des pays chauds. Jan. 1909, p. 47.

*Guttapercha* :—

Guttapercha trees of the Malay Peninsula. Kew. Bull. 1907, p. 109.

Imports of raw gutta into the United Kingdom. Ind. Journ. 15. 7. 1907, p. 88.

Notes on Karité gutta. Spence Q. J. L'pool I. C. R., Jan. 08, p. 61

De melksapvaten bij Caoutchouc en Getahpercha leverenden Planten. Verslag Salatiga 1907, p. 43.

Essai d'extraction de Gutta par Saignéé sur Palaquium cultivees à Tamatave, Journ. d'Agric. Tropicale, May 1909. p. 154.

Gutta-percha planting in Java, Ind. Rubber Wrld. Mar. 1909. "T.A." Aug. p. 106.

*Helicteres* :—

Helicteres fibre. "T.A." July 1907, p. 17.

*Hemp* :—

Charas or Indian hemp. Hooper. Ind. Agric. Oct. 1908, p. 302.

New Zealand Hemp Industry. Queens. Ag. Jl. Dec. 1908, p. 318.

*Indigo* :—

Der Indig. Tropenfl. 1907, p. 621.

Indigo—a retrospect. Ind. Agric. Mar. 1908, p. 73.

Research work in Indigo, carried out at Balasingh Serai, Blozam and Leake. Calcutta 1905.

A contribution to the Indigo question. Nature 30. 7. 1908, p. 296.

L' Indigo à la Station de cultuur experimentales de Quang-Ngai Bull Economique d'Indo—China, May 1909, p. 201.

*Ipecacuanha* :—

Ipecacuanha. Str. Bull. 6. 1908, p. 134, "T.A." Sept. 1908, p. 224.

Note on Ipecacuanha cultivation. Str. Bull. Aug. '09. p. 363. "T.A." Oct. p. 306.

*Irrigation* :—

Well Irrigation. Ind. Agr. Nov. 1904, p. 345.

Notes on methods of irrigation in Arizona. Park in "T.A." Sept. 1906, p. 271.

Furrow Irrigation. Howard. Agr. Jl. Ind. July 1908. "T.A." Nov. 1908, p. 459.

Lining of ditches and reservoirs to prevent seepage losses. Haw. Forester, July 1908, p. 172.

Irrigation Methods. A. S. Kenyon. Phil. Agr. Rev. I. 10. Oct. 1908.

A current pump for irrigation. Agr. Gaz. N. S. W. XX. I. Jan. 09, p. 53.

*Jute* :—

Jute *vs.* rice. Ind. Agric. 1. 10. 07, p. 295.

Crops in rotation with Jute. do. Apr. 1908, p. 112.

Notice sur le jute. Bull. Jard. Col. June 1908, p. 516.

Burkill and Finlow. The races of Jute. Agr. Ledger, 6. 1907, V. P. Series, 105.

do. On three varieties of *Corchorus capsularis* which are eaten. Proc. Ass. Soc. Bengal, 3. 1907, p. 633.

Jute and jute substitutes from West Africa. Imp. Inst. Bull. 6. 1908, p. 126.

Jute growing in Assam. Ind. Agric. Nov. 1908, pp. 328, 329.

Experiments in Jute Cultivation in Bengal. Imp. Inst. Bull. 6. 1908, p. 292.

do. Ind. Agric. Dec. 1908, p. 382.

Note sur le Jute de Chine. L' Agr. Pratique des pays chauds. Jan. 1909, p. 77.

Jute cultivation in Burma. Ind. Agric. Apr. 1. 1909, p. 126.

Heart damage of baled jute. Agr. Journ. India, July 1909, p. 276.

Jute in 1908. Ind. Agric. Jan. 1909. "T.A. Dec. p. 491.

---

## PLOUGHS: THEIR SETTING AND SPECIAL FEATURES.

BY W. J. MALDEN.

(From the *Agricultural Gazette of New South Wales*, Vol. XX., Pt. 8, August, 1909.)

The machines now used on the farm include some with many very intricate parts, and they perform their work satisfactorily, although some are not more than a generation old. This is satisfactory. But then there is the simple plough, old almost as sin, yet one does not always see good ploughing, or the plough set so that it can do the best work. It seems as though our engineers can contrive to make machines to do intricate work with ease to the operator, who has little more to do than press a lever, and the machine does the

rest; but when a plough is turned out the operator has to apply his skill to make it go well. The maker, however, provides reasonable means of adjusting. The fact is, a plough requires more skill to set properly than the uninitiated might suppose. The setting that will suit one soil will not necessarily suit another. Who is there that has ploughed on land which is very variable who has not had the experience that at one end of the field there is a tendency for the big wheel to run away from the land side, while at the other it will cut too hard on the land side, or, again, where it will pull in much deeper in one place than another, although the service is equally hard? When this occurs it is most difficult to set the plough just right to suit all conditions. Where the land is normal from end to end and the soil in fair ploughing condition, a well-made plough, well set, *should go from end to end without being touched by hand.* That is the best test that can be applied. Too often one sees the ploughman fail to make the mind triumph over matter, for, instead of adjusting the plough properly, he may be seen with one foot (sometimes two), out of the furrow, struggling to keep the plough in place, leaning the greater part of his weight on the handles, and so increasing the under-friction that the draught is excessively increased, and horses can only get along in snatches, suggesting that first the horses have a pull at the plough, and then the plough has a pull at the horses, both man and horses being thoroughly done up at shutting out time.

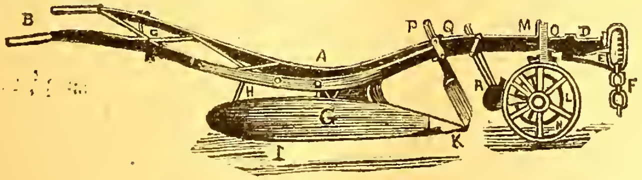
### The Science of Grip.

There is nothing which adds so much to draught as the weight which the holder puts on to the handles. A man may hold a plough firmly and yet add but little to the draught, and a well-set plough requires this rather than pressure. A plough that a skilled ploughman cannot set to run easily on fair land should be broken up, as it is a very expensive implement to keep. But if one looks over a plough that is difficult to hold, it is odds in favour of the fact that there is one or another of the nuts that regulates some adjustment that has never been moved since it came from the work, as can be proved by the fact that the paint has not been disturbed, while perhaps it is so long since others were moved that they are rusted in.

A plough should be easily adjusted, and this is not convenient unless all nuts and screws are kept well greased. It is as much or even more than some will do to keep the hubs of the wheels greased, and as the ploughboy whistles o'er the lea so do the wheels. If the wheels are not kept greased they soon wear loose, and then not only will the furrow be uneven in width, but as they roll one way or the other so will the plough follow the direction just as a bicycle does, and the man will have to hold against this tendency to run out of the straight; the lolling of the wheel also alters the depth of the ploughing, for it is not the same height when lolling as upright. The necessity for thin washers or cotters to use as soon as there is play should not be overlooked. Nothing better teaches a young ploughman the purpose of the parts than being made to take a plough to pieces, and to take out every bolt, and then put it together again. It is not time wasted in the long run, though because a plough looks so simple few are called upon to do it. For the best effect to be obtained he should be told the purport of each part.

### Part Adjustment.

The main parts which are employed to adjust an ordinary mould-board plough are the wheels, the T-head, the sliding head, the draught chain, the share, the coulter, skin coulter, breast stay, and the handles. Beyond these, however, are the less recognized points where, through some temporary or constructional deficiency, some little ingenuity is required to make the plough run easily. The wheels mainly control the width and depth of the furrow, yet on swing ploughs these are absent, thus showing they are not indispensable.




The Common Plough.

A, Beam; B, Handle or slits; C, Handle Stay or brace; D, T-head; E, Sliding Head; F, Draught Chain; G, Breast or mould-board; H, Breast-stay; I, Mould-board Rest; K, Share; L, Land-wheel; M, Land-wheel Standard; N, Furrow-wheel; O, Furrow-wheel Standard; P, Coulter; Q, Coulter-clip; R, Skin Coulter.

where ploughs are, however, most commonly used, and on the whole advisedly so; but there is no doubt that there would be better ploughmen if everyone had to learn to hold a plough without wheels, for then he would have to give attention to points which he regards but little when using a plough mainly held in position by the wheels; just as a boy who learns to ride a horse bare-backed over a hurdle acquires a seat that will always make him sit closer and be safer balanced than one who has always depended upon stirrups. The holding of the plough itself is very much a matter of balancing, and a beginner wants to get the knack of it, both for his own sake and for the sake of the horses, for he then does with very little effort what another does less well by much greater exertion. Where the evenness of the surface permits it, the plough runs more steadily when the little wheel is set wide, but when ploughing on land with a decided and varying incline the greater width between the wheels accentuates the effect on the furrow, for when the little wheel is on the lower side the ploughing is so much deeper than the level, while when it is on the upper side it is so much shallower. It is in cases such as these that the gallows plough, with the wheels on the fore-carriage allowing the beam free action to turn to either side, and so keep the body of the plough perpendicular, or under the independent balancing of the holder, is really a valuable implement.

### WHEELS MUST RUN PLUMB TRUE.

Where the wheels are depended upon to regulate the depth of the ploughing it is very important that they, and the standards and axle supporting them, are kept plumb true. If any part is bent it should be put right by the blacksmith, and any temporary derangement be set right by packing with a wedge to correct it. To set off the coulter also should be arranged to assist the running. Where there is a tendency for the plough to run away from its work, it should be set a trifle wide to pull it back; but if it runs in, then it should be sent narrower. The coulter can greatly aid when the plough runs away from its work through the land side of the point becoming rounded and having a tendency to follow the inclination of the curve so formed. The coulter is ordinarily best set fairly well forward, but on stony grounds it is desirable to set it so that a stone does not pitch between it and the share. By setting a coulter point fairly forward, by its inclination it runs freely into the softer ground below, and the cut is made up the edge, and the hard surface yields more easily so than when it is attacked more vertically. Sharp knives make easy work, blunt knives hard work; therefore the coulter, which is a knife blade should be kept sharp. Sometimes one sees them little more than a round bar with three or four inches flattened and thick to do the cuttings—which is not economical. The nice adjustment of the coulter is very essential to the easy running of the plough.

### THE SKIM COULTER.

The skim coulter should be set to throw dung, stubble, or weeds into the furrow, and should always be provided with a sharp share, because, from its position, if it does not cut in easily, but rides on the surface, it makes the plough run very unevenly and jumpily. Considering how well the ordinary skim coulter turns its little furrow it is strange that it was not sooner adopted for bigger work, as it is made practically on the same lines as the modern digging plough. The share which cuts the under part of the furrow as the coulter cuts the side (the other two sides not requiring cutting), requires to be fit well in the socket and should be in proper alignment. Where there is structural fault which prevents the share being in proper line the plough will be difficult to hold, and if through wear there is looseness the share must be corrected by the use of thin leather wedges. When a new share is put on after one that has worn short, the ploughing will be considerably deeper because the share is set with a downward pitch, and if the line is carried forward it would be seen that it would run below the bottom of the big wheel, therefore every half-inch worn back from the point appreciably reduces the depth of the furrow; as most shares have rather greater inclination at the point this is accentuated. On some soils the drawing in, by pulling the wheels tighter down, will make the furrow deeper than the line of inclination indicates especially where, as is often the case, the old share has not only been shortened, but the point has worn slightly upwards and tended to lift the plough.

Many years ago there was introduced an ingenious attachment to readily counteract the effect of a new share by making the neck into which the share socketed adjustable. This was called a lever neck, and was placed between the breast and the body.

### NICER POINTS OF SETTING.

The nicer setting of the plough is effected from the head or forepart of the beam, where there are two movable parts—one with a vertical movement, and the other with a lateral. That with the lateral is known as the head, or T-head, and that with the vertical as the hake or sliding head. In the steering of the plough it has to be remembered that it is mainly done by balancing, using the bottom of the body as a pivot. If one wants to make it run more shallow one weighs on the handles, and up comes the head. If one wants it to run to the right one shoves the handles to the left, and it pivots round, and so on. The sliding head is made with a series of notches, which allow the draught chain to be adjusted as desired. When the ground is hard there is a tendency for the share to run upwards, and though the holder can resist to some extent by pressing the head down by holding against the tendency, he can be greatly relieved by allowing the horses to help him. This he does by altering the height of the draught point. Remembering there is a pivot on which the plough balances, it is obvious that the higher the point of attachment the more will the fore-end of the plough be dipped, while the lower the more will it be lifted out. The sliding head, therefore, affords easy correction to other faults which tend against a furrow of even depth. The draught chain, however, can be made to assist, for if short the horses will lift the head, but if long they will pull it down. Ordinarily a short chain suffices, but on hard ground a longer chain gives great relief to the holder, and the plough runs steadier; also, on very hard ground, when the horses are pulling with jerks and rolling, a longer chains makes the plough go more steadily, as more play is allowed than when every motion of the horses is imparted directly to the plough.

The T-head is a continuation of the beam, and is quadrant-shape, with pin-holes at near intervals, and is used to assist in controlling lateral swerving of the plough. The pivot action has again to be regarded, and when it is desired to pull the big wheel away from the unploughed ground the sliding head is pushed to the left, and if it is required to bite the unploughed land it is pushed to the right, being held in place by means of a pin thrust through holes corresponding in the T-head and the sliding head. The alteration of the position of the sliding head to the rigid beam is necessary also, because the line of draught is widely different when horses draw in single line, when two are abreast, or when three are abreast, as each one necessitates the draught being more or less on one side or the other of the line of the beam, accordingly as the centre of the main whipple-tree is to the line of the beam so must the sliding head be fixed, and remembering the plough pivots it has to be set wider in opposition to the way it is desired to turn the head of the plough.

### THE RUN OF THE PLOUGH.

The setting of the breast or mould board also influences the run of the plough, as the wider it is opened—that is, shoved out by the breast stay—so will it turn the share point on to the work. With all these means of adjusting, it looks as though the setting of a plough ought to be a very simple matter, but the struggling efforts of many ploughmen give contradiction to this. In fact, to get all these points in harmony takes a considerable period to learn; moreover, they are subject to alteration every time different work is done, and beyond all this is the knowledge which directs the best type of work to be done for the purpose ahead.

When the plough is properly set, and, of course, still more so, when ill-set, there is much to do to make it run so as to give less strain to the horse and man. By-the-by, one ought to have mentioned that a furrow set deeper on the wing side of the share is always heavier in draught than one set with a level sole or slightly deeper on the little wheel, because the share cuts clean across when it is flat, but when the wing is lower than the preceding furrow the new furrow has to be torn out. On heavy land especially the line of fracture may continue downwards for a considerable distance, and instead of a 9-inch furrow it may break out 13 or 14 inches, bringing up very objectionable subsoil. This constitutes coarse ploughing. Coarse ploughing is not dependent upon the depth and width of the furrow, but to this breaking out of the subsoil.

When one says the plough is balanced with the centre as a pivot this must not be taken to mean that there is merely one spot which acts as pivot; it is spread over quite a big portion of the body and breast, as occasion demands, and experience alone teaches where to apply from time to time.

### TURNING NOT EASY.

The turning of a plough is by no means an easy matter to a novice; in fact, we recall from the memory of long

gone days the fact that several friends, assertive in other matters but innocent of ploughing, beyond the universal ability to criticise everything in farming, found that there was nothing which would more quickly and unexpectedly land them in a ditch. We used to choose a rather wet headland on heavy land to accomplish this, and if they only stuck long enough to the handles the ditch inevitably received them, and they were usually far less assertive on agricultural matters subsequently. Turning is practically a matter of balancing, and one requiring some experience, to enable the plough to set in square without wriggling or stopping. The plough should always be balanced round; that is, jerked out and thrown on the breast side; then there is no ploughing or cutting up of the headland, with its inevitable mauling on wet land. In some light land districts it is common to see the plough allowed to run round on the little wheel, and there it does not so much matter; it is no easier to the holder and, except on these light soils, very prejudicial to the headland. If a plough is balanced round it is easy to throw the head into proper line, and if it falls short to turn it on to the wheel opposite to the direction it is desired to take, and let the horses pull it in.

## THE RELATION OF SCIENCE TO HUMAN LIFE.

(From *Nature*, Vol. 82. No. 2095, December, 1909).

In casting about for a suitable introduction for my address this afternoon, I came across some words written by a great Englishman which with your permission I will read to you.

"Remember the wise; for they have laboured, and you are entering into their labours. Every lesson which you learnt in school, all knowledge which raises above the savage and the profligate—who is but a savage dressed in civilised garments—has been made possible to you by the wise. Every doctrine of theology, every maxim of morals, every rule of grammar, every process of mathematics, every law of physical science, every fact of history or of geography, which you are taught, is a voice from beyond the tomb. Either the knowledge itself, or other knowledge which led to it, is an heirloom to you from men whose bodies are now mouldering in the dust, but whose spirits live for ever, and whose works follow them, going on, generation after generation, upon the path which they trod while they were upon earth, the path of usefulness, as lights to the steps of youth and ignorance.

"They are the salt of the earth, which keeps the world of man from decaying back into barbarism. They are the children of light. They are the aristocracy of God, into which not many noble, not many rich, not many mighty, are called. Most of them were poor; many all but unknown in their own time; many died and saw no fruit of their labours; some were persecuted, some were slain, as heretics, innovators and corruptors of youth. Of some the very names are forgotten. But though their names be dead, their works live, and grow and spread over ever fresh generations of youth, showing them fresh steps towards that temple of wisdom which is the knowledge of things as they are; the knowledge of those eternal laws by which God governs the heavens and the earth, things temporal and eternal, physical and spiritual, seen and unseen, from the rise and fall of mighty nations to the growth and death of moss on yonder moors."

So spake Charles Kingsley, and his words I make use of as an introduction which strikes the key-note of what I have to say to you to-day.

The subject which I have chosen for my address—the relation of pure science, and especially of biological science, to human life, and inferentially the relation which ought to exist between pure and applied science in a college of science, is naturally of great interest to us in the Imperial College, which is a college of science and technology, and the purposes of which are, in the words of the charter, "to give the highest specialised introduction and to provide the fullest equipment for the most advanced training and research in various branches of science, especially in relation to industry." Particularly do I desire to set forth as clearly as I can the justification for including in a college which deals not only with science, but with science in relation to industry, those branches of science which deal with organisms.

As industry forms the principal occupation of human life, and as the phenomena of organisms constitute the science of life, it may seem absurd to set out solemnly to justify the inclusion of the biological sciences in a college which deals with science especially in its relation to human life. Nevertheless, having regard to the fact that I have heard some doubt expressed as to whether the cult of the biological sciences

properly falls within the scope of the Imperial College, it may not be out of place to bear the matter in mind on this, the second, occasion of the prize-giving of our new college.

What is the meaning of the word *science?* As in the case of so many words, its meaning has become confused by its partial application, *i.e.*, by its application to a part only of its contents, and this has often led to a misapprehension of the relation of science and of the scientific man to life. Science simply means knowledge, and to speak of scientific knowledge, as opposed to ordinary knowledge, is to use a redundant phrase, always supposing that we are using the word knowledge in its strict sense. Huxley defined science as organised commonsense, by which, I take it, he meant knowledge of things as they are—knowledge the reality of which can at any time be checked by observation and experiment; for commonsense, if it is anything, is the faculty by which we are made aware of reality. Science is sometimes spoken of as exact knowledge, but I am bound to say that I do not like the phrase exact knowledge; it seems to imply an insult to the word knowledge. Its use reminds me of a friend of mine who, when he was offered one morning at breakfast a fresh egg, mildly asked, "In preference to what other kind of egg?" It recalls those regrettable phrases one so often hears, I *honestly* believe, or I *honestly* think; one wonders how the people who make use of them usually believe and think.

It must, I think, be admitted that science simply means knowledge, and that there is nothing peculiar about the knowledge of scientific men by which it differs from other knowledge.

Scientific men are not a class apart and distinct from ordinary mortals. We are all scientific men in our various degrees. If this is so, how comes it that the distinction is so often made between scientific men and non-scientific men, between scientific knowledge and non-scientific knowledge? The truth appears to lie here: though it is true that all men possess knowledge, *i.e.*, science, yet there are some men who make it their main business to concern themselves with some kind of knowledge, and especially with its increase, and to these men the term scientific has been technically applied. Now the distinctive feature of these men, in virtue of which the term scientific is applied to them, is that they not only possess knowledge, but that they make it their business to add to knowledge, and it is this part of their business, if any, which justifies their being placed in a class apart from other possessors of knowledge.

The men who make it their main business to add to knowledge may be divided into two classes, according to the motive which spurs them on. (1) There are those whose immediate object is to ameliorate the conditions of human life and to add to its pleasures; their motive is utility, and their immediate goal is within sight. Such are the great host of inventors, the pioneers in agriculture, in hygiene, preventive medicine, in social reform, and in sound legislation which leads to social reform, and many other subjects. (2) There are those who pursue knowledge for its own sake without reference to its practical application. They are urged on by the desire to know, by what has been called a divine curiosity. These men are the real pioneers of knowledge. It is their work which prepares the way for the practical man who watches and follows them. Without their apparently useless investigations, progress beyond the limits of the immediately useful would be impossible. We should have had no applied electricity, no spectrum analysis, no asceptic surgery, no preventive medicine, no anæsthetics, no navigation of the pathless ocean. Sometimes the results of the seeker after knowledge for its own sake are so unique and astounding that the whole of mankind stands spellbound before them, and renders them the same homage that the child does the tale of wonderful adventure; such is the case with the work on radium and radioactivity, which is at present fixing the attention of the whole civilised world. Sometimes the work is of a humbler kind, dealing apparently with trivial objects, and appealing in no way to the imagination or sense of the wonderful; such was the work which led to and formed the basis of that great generalisation which has transformed man's outlook of nature—the theory of organic evolution; such was the work which produced aseptic surgery and the great doctrines of immunity and phagocytosis which have had such tremendous results in diminishing human pain. The temper of such men is a curious one; no material reward can be theirs, and, as a rule, but little fame. Yet mankind owes them a debt which can never be repaid. It is to these men that the word scientific has been specially applied, and with this justification—they have no other profession save that of pursuing knowledge for its own sake, or, if they have a profession, it is that of the teacher, which, indeed, they can hardly

avoid. Ought such men, working with such objects, to find a place in the Imperial College?

It is a curious thing, but it has only comparatively recently been realised, that a sound and exact knowledge of phenomena was necessary for man. The realisation of this fact, in the modern world at any rate, occurred at the end of the Middle Ages. It was one of the intellectual products of the Renaissance, and in this country Francis Bacon was its first exponent. In his "Advancement of Learning" he explained the methods by which the increase of knowledge was possible, and advocated the promotion of knowledge to a new and influential position in the organisation of human society. In Italy the same idea was taught by the great philosopher Giordano Bruno, who held that the whole universe was a vast mechanism of which man, and the earth on which man dwells, was a portion, and that the working of this mechanism, though not the full comprehension of it, was open to the investigation of man. For promulgating this impious view both he and his book were burnt at Rome in 1600. You will find the same idea cropping up continually in the written records of that time; Corpernicus gave it practical recognition when he demonstrated the real relation of the sun, and it was thoroughly grasped by our own Shakespeare, who gave it expression in the dialogue between Perdita and Polixines in the *Winter's Tale*:—

*Perdita*—
The fairest flowers of the season
Are our carnations and streaked gillyvors,
Which some call Nature's bastard: of that kind
Our rustic garden's barren; and I care not
To get slips of them.

*Polixines*—
Wherefore, gentle maiden, do you neglect them?

*Perdita*—
For I have heard it said
There is an art which, in their piedness, shares
With great creating nature.

*Polixines*—
. . . Say there be;
Yet nature is made better by no mean,
But nature makes that mean: so, o'er that art
Which you say adds to nature, is an art
That nature makes. You see, sweet maid, we marry
A gentle scion to the wildest stock and make conceive a bark of baser kind
By bud of nobler race: this is an art
Which does mend nature,—change it rather; but
The art itself is nature.

It is not difficult for us, though it may be difficult to our descendants, to understand how hard it was for man to attune himself to the new, this mighty conception, and the intellectual history of the last three hundred years is a record of the struggles to make it prevail.

Trained through long ages to believe that the heavens were the abode of the gods, who constantly interfered in the daily affars of life and in the smallest operation of nature, it seemed to men impious to maintain that the earth was in the heavens, and to peer into the mysteries which surrounded them, and the endeavour to do so has been stoutly resisted; but the conflict, in so far as it has been a conflict with prejudice, is now over. It vanished in the triumph of the modern views on the origin of man which will be for ever associated with the names of Lamarck, Spencer, and Darwin.

The triumph of these views does not mean that they are correct, or that we know anything more about the great mystery of life than we did before. He would be a bold and a prejudiced man who made that assertion. What it means is this, that man is grown up, that he has cast off the intellectual tutelage under which he has hitherto existed, that he has attained complete intellectual freedom, and that all things in heaven and earth are legitimate subjects of investigation. But it means even more than this; it means that the conviction is rapidly growing upon him that the only way in which he can hope to improve his condition is by understanding the laws, physical as well as spiritual, under which he exists, and this he is determined to try to do by the only method open to him—that of minute and arduous research.

And is it, I ask, an unworthy ambition for man to set before himself to understand those eternal laws upon which his happiness, his prosperity, his very existence depend? Is he to be blamed and anathematised for endeavouring to fulfil the divine injunction, *Fear God and keep His Commandments, for that is the whole duty of man?* Before he can keep them, surely he must first ascertain what they are!

We hear a great deal nowadays about the humanities and the humane studies —the study of "ancient elegance and historic wisdom"—and I should be the last to minimise in any degree the value and intense interest which is attached to the study of the writings and utterances of the mighty dead. They will always retain undimmed their

attraction and inspiration for man, and man will always think with gratitude and affection of their authors; but it is possible to overdo a thing, and this talk of the humanities and humane studies has been overdone. After all, a live dog is better than a dead lion—but in this case we are dealing with a living lion.

It is ridiculous to say nowadays that the study of humanities consists solely of the study of the writings and philosophy of the ancients; to take that view is to take the view of the schoolmen; the death-blow to which was given by Bacon and Bruno.

We have got beyond that; we claim that the true study of the humanities is a far wider thing—it is the study of the stupendous mechanism of the universe of which man forms a part, and the understanding of which is necessary for his happiness. That is the true humanity of which the other forms only a small portion. The time is coming when the principal preoccupation of man shall be the gradual disclosure of this mechanism and his principal delight the contemplation of its beauty. For remember what Plato himself said: the whole of nature, so far as it really exists, is a revelation of God.

In spite of the work and writings of such men as Bacon and Bruno in the end of the sixteenth century, the progress of science was at first but slow and the workers few. We have, of course, the immortal achievements of Newton and Harvey, and the foundation of the Royal Society, and the tremendous outburst of scholarship as typified in this country by Bentley and his co-workers; but the eighteenth century was, on the whole, characterised by intellectual quiescence both in scientific output and in literary creation. The quiescence was apparent rather than real. To borrow a metaphor from the garden, though there was little growth above ground, active root formation was going on. Linnæus (1707-1778) was at work in Sweden creating the framework which rendered future work in botany and zoology possible; Buffon in France was cautiously feeling his way towards a theory of organic evolution; Henry Cavendish (1731-1810), Joseph Priestly (1733-1804), and Antoine Lavoisier (1743-94), were laying the foundation of modern chemistry; Albrecht von Haller (1707-77), Kaspar Friederick Wolff (1733-94), and John Hunter (1728-93), those of anatomy and physiology. The spade-work of these men, together with the improvement of the microscope, was necessary for the great outburst of scientific investigation which characterised the ninteenth century. Ushered in by the work of Cuvier (1769-1832), Lamarck (1744-1829), St. Hilaire (1772-1844), in biology, Thomas Young (1773-1829), Laplace (1749-1827), Volta (1745-1827), Carnot (1758-1823), in physics, it was adorned in its middle and latter period by the names of Davy, Faraday, Dalton, Arago, Rochard, Owen, Darwin, Lyell, John Muller, Agassiz, Helmholtz, Stokes, Kelvin, and Pasteur.

The advance of knowledge is yearly becoming more rapid; if its steps were slow and hesitating in the seventeenth and eighteenth centuries, and if it quickened to a rapid walk in the nineteenth, we now hear the sound of a trot, which at the end of the century will be a gallop, and as the centuries succeed one another its pace will become even faster. Where will it lead us, and what will be the upshot for man?

But it is no part of my purpose to-day to give you an historical summary of scientific progress. The point I wish to illustrate is the vast increase in the scientific army and in the results achieved by them.

My thesis is that pure research into the sequence of natural phenomena is in itself of the greatest importance to the progress and welfare of humanity, and that a great statesman can have no higher aim than to solve the problem of how it may best be fostered. To what extent can such a thesis be justified by experience?

I might begin by examining the origin and progress of our knowledge of what is called current electricity, to which modern life, from a material point of view, owes so much. In illustration of what we owe to workers in electrical science I need only mention land telegraphy, ocean telegraphy, wireless telegraphy, telephones, electric light, electric traction, and our knowledge of radio-activity. The history of this science forms, perhaps, the best example of the importance to man of pure, apparently useless, scientific research, for at every stage of it, from Galvani's original observation through the discoveries of the Swede Oersted and of the Frenchman Ampere to those of our own Faraday and to the theoretical adumbrations of Clerk Maxwell and to the researches of Crookes on the passage of electricity through vacuum tubes, we meet with the investigation of phenomena which were apparently perfectly useless, and which to most practical men must at the time they were made have appeared as little more than scientific toys provided

by nature for the harmless amusement of the queer people who meet in the rooms of the Royal Society and such like places where unpractical oddities resort. And yet I ask you to reflect upon the astounding results which have arisen from Galvani's observations made to discover the cause of the twitching of the frog's legs, and to Faraday's discovery of induction, and to indulge your imaginations in an endeavour to predict what may issue for man from Crookes's investigations of the glow without heat of the vacuum tubes.

But I have neither the knowledge nor the time to dwell upon the physical side of the science. As in private duty bound, I must devote the short time at my disposal to examples culled from the biological sciences.

(*To be continued.*)

## THE EDUCATION OF THE YOUNG FARMER.

BY ALEX. HOLM,
General Manager, Government Experimental Farm, Potchefstroom.

(From the *Transvaal Agricultural Journal*, Vol. VIII., No. 29, October, 1909.)

This question is one of the greatest interest and moment at the present time, when the agricultural industry of the whole of this sub-continent is now entering upon a new era. Much information and advice have already been given in the pages of this Journal, in the Director of Agriculture's reports, and in the Press, in regard to the value of agricultural education and the steps to be taken to make it an accomplished fact.

This short article is not intended to cover such a field, but rather to discuss the actual conditions which arise in considering how a youth's education should be directed, if he intends to become a farmer, and to give the lines along which such an education should proceed. The importance of giving every facility to our future farmers for obtaining an insight into, and a thorough grasp of, the diverse problems and methods of agriculture can hardly be exaggerated; the more so because success or failure to an ever-increasing extent depends upon the farmer's ability to compete with his brothers engaged in similar pursuits in different parts of the world, all disposing of their products in a common "clearance house."

A word, also, in regard to territorial conditions. In all new countries, and here South African conditions apply, there is the greater necessity for the systematic training of the young farmer because the problems are ever new and there is little accumulated experience—the natural inheritance of the son from the father—such as one finds in countries older agriculturally. Here, again, a greater proportion of the future farmers will be drawn from a class almost wholly unconnected with farming pursuits, excepting in so far as they have become owners of properties hitherto almost entirely undeveloped. Such young men do not, therefore, start with that knowledge of country, animal, and plant life which a "son of the soil" almost unconsciously imbibes during his boyhood. The training of such youths, to be successful farmers, requires much patience and must be well directed, otherwise the effort will result in many failures.

It may here be observed that this question is being considered chiefly from the standpoint of the youth who is to become a farmer of no small means, and whose parent or guardian is in a position to provide for the education and training referred to hereunder. According as our agricultural educational system becomes more established provision will probably be made through scholarships and bursaries for the education of a limited number of "bright" youths who are, for pecuniary reasons, otherwise unable to receive such a training. For the remainder—and unfortunately, those constitute a large proportion of our future farmers—arrangements will require to be made for imparting to them through special courses of instruction a knowledge of such subjects as are taught in other countries in "winter schools" and other short intermittent courses.

This is not the place to discuss in detail the elementary education of the boy; suffice it to say that it can be too thorough. The important points to be kept in view in the education of the future farmer is a sound knowledge of the languages of everyday use, in order that he may be able to properly express his thoughts and convey his requests in writing, and further in order that he may be able to grasp the views of those from whom he may have much to learn. Of no less importance is arithmetic (including mensuration), and with it the ability to mentally calculate rapidly and correctly. It must be remembered that no small part of his affairs will be connected with holding his own against astute business men. For that reason, these remarks should not be lightly set aside. Language and

arithmetic should then be the bulwarks of his elementary education. Obviously it will, and should, go further. The "modern" side, *i.e.*, the "science" course, as opposed to a classical curriculum, will be found to be most serviceabe for a boy whose future career is to be that of a farmer. A crucial stage in the lad's career is now arrived at. In the case of a son of a farmer the programme is simplified, but in the case of the town-bred youth the procedure requires more careful consideration. No hard and fast rules can be laid down as applicable to the several cases; much will depend upon the particular circumstances, family, and private considerations, the length of character of the lad, and so forth.

The requirements may be stated as follows, in the order in which under ordinary circumstances they should be dealt with :—

After school.—

(1) Farm life ;
(2) Commercial training ;
(3) Course at an agricultural school or college ;
(4) Further experience of farming.

(1) *Farm Life.*

In the case of a farmer's son (1) and (4) can be omitted, unless it is arranged that the son takes up a style of farming not represented on his father's holding, in which case some practical experience should be acquired after leaving the agricultural school or college. In the other case, a "town-bred" lad who desires to become a farmer should, immediately after leaving school, spend six to twelve months actively employed on a good farm. This "period of grace" and experience will probably assist the lad in definitely determining whether he really cares for a farmer's pursuit. In some cases it will be found that a change of front has taken place, and that the lad finds that farming does not provide the life of ease which he may have anticipated. Such individuals are better eliminated from the field at the outset before time and money are spent on a fruitless education. Through such experience, though short, he will be in a position to make better use of the morning spent at an agricultural college at a later date. Furthermore, his mind will have begun to discern and to appreciate the things which concern the country life.

(2) *Commercial Training.*

The fact that farmers as a class are not good "business" men cannot be disguised. The chief reason for this deficiency may be found in the fact that in but few cases have "would-be" farmers the opportunity of becoming acquainted with business methods. The matter can in a fair way be solved by placing the lad for about a year in a bank or suitable commercial house. Such a training will cause him to become conversant with commercial phraseology, correspondence, and procedure, and will teach him to be exact and methodical. The commercial experience can be under taken at the end of the full course of training. By placing it at the beginning a change of opinion on the part of the lad is safeguarded against.

(3) *The Agricultural School or College.*

Relatively, a training at such an institution is the most important in the career indicated. A properly equipped and staffed establishment of this description provides an education which cannot be secured by any other means. It may be argued that many highly successful farmers all over the world, and particularly in the older countries, have never received such a training. This is quite true, but that is not sufficient reason why it should be denied to the farmer of the future. These same successful men would probably be the first to admit that it would be greatly to their advantage if they had obtained such a training. Year by year farming is becoming more complicated and specialised, and under rapidly changing conditions systems have to be altered from time to time, probably several times during the life of an individual farmer, in order to cope with changes brought about by external conditions. The man who starts equipped with a wide and general knowledge of agriculture in its broadest sense is the one who will be able, when circumstances demand it, to fall into line and adapt his methods to suit the altered conditions.

An agricultural college education is the best means to accomplish this purpose. Such a training, *e.g.*, in agriculture, stock-breeding and management, chemistry, biology, veterinary science, bookkeeping and surveying, and farm engineering, building construction, carpentry, blacksmithy, dairying, poultry-keeping, and horticulture, is in itself a good general education. It quickens the intellegence, broadens the mind, and equips the farmer in such a way that he thoroughly understands the "why" and "wherefore" of his calling; and when occasion arises he is in the position to make practical use of the discoveries of science, and the results

of experimentalists, to his pecuniary advantage. No one is in a better position to reap the greatest reward from a course at an agricultural school than the "son of the soil." It cannot be too strongly urged that farmers should not regard their "farmer son's" education as complete without a course at such an institition. The education of a lawyer, of an engineer, of a physician, has really only earnestly begun when he has graduated; why, indeed, should the brother who has determined to "follow the plough" be deprived of even the graduation course of an education which in a similar way qualifies him for his calling.

A full course such as has been described usually covers a period of two to four years. It may here be observed that an institution attempting to teach such subjects to the best advantage should have attached to it a good farm, thoroughly representative in its character, and manage along sound up-to-date and practical lines. Above all, an agricultural atmosphere should permeate the establishment, from the teachers down to the students.

It will not be out of place to give a warning to those responsible for the control of such institutions. Not infrequently does it happen that they are made use of by young men who have no earnest purpose, and who are simply "marking time," by parents and guardians who find such an institution a convenient and inexpensive abode to place their charges for a period until "something turns up," and by those who are physically unfit and are recommended to a country life to recuperate. Such young men will defeat the purpose of the institution, will lower its credit, and will simply represent so much waste effort.

(4.) *Further Experience.*

The young farmer's career has now reached a stage when he is in a position to put into practice that which he has been taught, but certain experience has yet to be obtained. He is now equipped with a general knowledge of all branches of agriculture. Probably by this time the lad will show a preference for a particular style of farming, *e.g.*, stock-farming (of one or more kinds), tillage, fruit-growing, and so forth. As a general rule he would be well advised, before starting on his own account to spend two years with one or two good farmers, farming under the system which he intends to pursue. On such farms an opportunity will be afforded of gaining a knowledge of the value of buying and selling of ordinary stock, marketing conditions in general, and the management of labour. An agricultural college farm cannot, as a rule, offer such facilities. The foregoing remarks, as already mentioned, apply in particular to the training of the "town-bred" lad. The son of a farmer can, as a rule, obtain the necessary experience on his father's farm, and by visits to the farms of his relations. It will thus be seen that the curriculum of an agricultural education will, for the farmer's son, cover a period of three or four years, and for others at least six or seven years. A little consideration will show that it will be completed quite soon enough for responsibilities to be placed on young shoulders.

An idea, chiefly among those who have no experience of farming, commonly prevails, that one does not require to be possessed of much ability in any direction to succeed in farming. Fortunately, the hard lessons of "paying for experience" is fast changing this opinion. Many of the failures one sees on every hand are due to his misconception. A successful farmer requires to be a "man of parts." He must have an extensive and intimate knowledge of animal and plant life, and a specialised knowledge of breed of stock, or tillage, or both, as the case may be. He must further be a good "business man," a judge of character, have the ability to manage and organise labour, and be possessed of the power of application. He must also have acquired such an intimate experience and skill in all the varied operations of a farm, in order that, though he may not be called upon to perform them in after life, he may be able to instruct his employees how to carry them out, and to know at a glance when they are properly done and with sufficient expedition. Such an experience can only be gained by the student taking an active part in the several operations of the farm on which he is trained. It cannot be acquired by becoming merely a "looker on, "as so many unfortunately imgaine. It is hoped that these remarks will persuade parents not to advise any dull or indolent sons to become farmers.

It should be the ambition of the young men who have had the opportunity and have taken advantage of the course of training herein described, to become the "leaders" in their own particular district or colony. One leads, others follow. Thus progress, ever silent, but none the less sure, makes headway.

These thoughts have been placed on record in the hope that they may serve

as a guide to the education and training of the future farmers of South Africa. By such means this land, so rich in natural resources, will be assisted in achieving and maintaining in its proper place among the agricultural and pastoral countries of the world.

---

## SCIENTIFIC AND TECHNICAL DEPARTMENT.

(From the *Report on the Work of the Imperial Institute*, 1908, No. 601, July, 1909.)

The facilities offered by this Department, which were fully described in the Report for 1906-7, have been largely utilised during 1908 for the conduct of investigations and the supply of information respecting the problems of tropical agriculture and the utilisation of raw materials, mineral and vegetable.

The number of investigations and enquiries requested by the Colonies and India in 1908 was 375; the number of reports completed was 393; and at the close of the year 141 investigations were in progress. The subjects which were investigated and on which reports were completed are referred to in the following sections under the headings of the various groups of commercial products to which they related. The countries represented were:—Cyprus, Malta, Egypt, Sudan, Somaliland, Uganda, British East Africa, Zanzibar, Nyasaland, Rhodesia, Natal, Transvaal, Cape Colony, Gambia, Sierra Leone, Gold Coast, Southern Nigeria, Northern Nigeria, St. Helena, Mauritius, Seychelles, India, Ceylon, Straits Settlements, Federated Malay States, Johore, Fiji, Australia, Falkland Islands, West Indies, British Guiana, British Honduras, Bermuda, Newfoundland, Canada, Portuguese East Africa, Madagascar, Norway, Turkey, Greece, Brazil, Mexico, China, Japan, French Dahomey, and Liberia.

Brief allusion may be made here to some of the more important work of this Department during the year.

A very large number of samples of cotton, representing, as a rule, either native cotton or cotton experimentally grown in British Possessions, have been examined and reported on, and several important questions relating to the cultivation and growth of cotton have been dealt with. In connection with the advances which have been made in the tropical Colonies in the successful growth of cotton, it is becoming more and more apparent that in many cases the best results are being obtained by the improvement of native cottons, or cotton already established in the country, rather than in the attempts to establish exotic plants. The probability that this would prove to be the case was emphasised in several publications which have been issued by the Imperial Institute (*see* especially Professor Dunstan's Report on Cotton Cultivation in the British Empire and in Egypt (1904); Hand Book to the Cotton Exhibition, Imperial Institute (1905); British Cotton Cultivation (1908). It is very desirable that systematic work on this subject, including hybridisation experiments, should be steadily continued in connection with the Agricultural Departments which have now been established by Government in nearly all the tropical Colonies and Protectorates.

The maintenance of a reference collection at the Imperial Institute of standard cottons and of cotton produced in every British Possession have proved of much practical value. It has been largely consulted by those concerned with cotton cultivation and with the cotton industry in this country.

At the instance of the Colonial Office, the Director visited the cotton districts of Asia Minor in 1907, and his report on the growth of cotton in that country and its possibilities was published as a Parliamentary Paper (Cd. 4324, 1908).

Much attention has also been given to fibres other than cotton, and a very large number of samples have been examined and reported on. Cultivation experiments have been conducted in several Colonies in communication with the Institute, with a view to the production of fibres suitable for cordage and as substitutes for jute, especially in West and East Africa. In this subject the Imperial Institute has had the advantage of the co-operation of the principal users of these materials in this country.

Allusion may be made to the experiments now in progress in Sierra Leone and in other parts of West Africa with a view to the growth of species of Hibiscus and other fibres of value as substitutes for jute, and to the attempt which is being made to establish an industry for the growth of New Zealand hemp in St. Helena. In consequence of the continuous demand for information both in this country and in the Colonies respecting the work of the Imperial Institute on commercial fibres, the principal reports which have been made since the issue of the volume of "Technical Reports" in 1903 are now being collected and prepared for publication.

Attention may also be drawn to an interesting investigation which was commenced during the year with a view to determining the commercial possibilities of the "wild silk" produced by species of Anaphe in West and East Africa. In this connection the Institute had the advantage of the great knowledge of the late Sir Thomas Wardle, by whose death the Institute has lost a valuable referee on all matters connected with silk.

Another subject of much importance to several Colonies is the production of tobacco, and this has received considerable attention during the year with the help of the principal tobacco manufacturers in this country. The examination at the Imperial Institute of native, and experimentally grown tobacco having indicated the probability of the success of tobacco cultivation in several districts of West and East Africa, the Government approved the recommendation of the Director that a tobacco expert should be appointed in order to conduct systematic experiments and afford advice in tobacco cultivation and curing in Uganda and East Africa. In both these countries, and especially in the former the prospects of a tobacco industry are very favourable. Mention may also be made of the success which has attended the growth of tobacco of American and of Turkish type in Rhodesia, and to the satisfactory indication which have been obtained as to the possibility of successful tobacco cultivation in Northern and Southern Nigeria and in Sierra Leone.

The improvement of the native methods of obtaining and preparing "wild" rubber in West Africa has been specially studied, and the question as to the steps which should be taken to secure the adoption of improved methods is under consideration. If better methods were adopted the commercial value of West African rubber would be more than doubled.

One of the principal and most remunerative industries in the coastal regions of West Africa is the production of palm oil, which has long been conducted by the natives, who still employ primitive and wasteful methods. In view of the great demand in Europe for this product, and the probability that important uses can be found for it if prepared in a better manner, an investigation has been commenced at the Imperial Institute in co-operation with the Agricultural Departments of the Colonies concerned with a view to the improvement of this industry. The quantity and quality of the oil furnished by the fruits and kernels of the serveral varieties of oil palm which occur in West Africa will be determined, and steps will be taken to devise, if possible, a suitable method for the better preparation of the oil from the fruits.

In consequence of representations made to the Imperial Institute by manufacturing firms in this country and abroad as to the increasing demand for vegetable oils and fats suitable for the manufncture of butter substitutes, a large number of new and little known oil seeds have been investigated and afterwards submitted to technical trials by manufacturers. An investigation is being conducted for the Government of India in connection with the utilisation of Indian cotton seed oil for similar purposes. A special article summarising the commercial possibilities of a number of new and little-known oil seeds has been printed in the "*Bulletin of the Imperial Institute*," Vol VI., (1908), No. 4, pp. 353-380.

The Inspector of Agriculture for British West Africa (Mr. G. C. Dudgeon) has rendered valuable service to the Institute in collecting special information and materials for investigation, and also in directing local enquiries and experimental work in the several West African Colonies. The value of the work of this officer will be greatly enhanced when the Agricultural Departments now in process of organisation are in operation, since these departments will provide the means for systematic and continuous experimental work in agriculture which is necessary for the successful development of these Colonies.

The economic resources of the Seychelles have continued to receive considerable attention, especially in connection with the vanilla industry, the production of essential oils, and the utilisation of canning materials. A summary of the more important investigations conducted for the Seychelles has been printed in the "Bulletin of the Imperial Institute," Vol. VI (1908), No. 2, pp. 107-126.

In the subject of minerals much important work has been accomplished during the year, especially through the examination and commercial valuation of the minerals collected during the mineral surveys which are being conducted in several Colonies in co-operation with the Imperial Institute. In addition to the investigations for the surveys in Ceylon, Northern Nigeria, Southern Nigeria, and Nyasaland, which have been in progress for some years,

and have been the means of indicating the commercial possibilities of a number of minerals, preliminary surveys were in progress during the year in Uganda and in British East Africa, and these have already afforded evidence that these countries contain deposits which deserve full investigation. The results which have followed from the operations of these surveys clearly demonstrate the advantage of such work being conducted by Government on these lines, by which systematic search for minerals is made in the Colonies, and material collected for research work at the Imperial Institute in the communication with technical experts and manufacturers. In Ceylon, where striking results of commercial importance have already been secured, it is clear that much still remains to be done in following up indications obtained of the existence of valuable minerals, and in the technical development of certain deposits by modern methods which have hitherto not been adopted.

In Southern Nigeria attention has been chiefly directed to the occurrence of lignite and its possibilities as a fuel. The mineral surveyors have made a thorough exploration of the deposits and the value of the material and the best modes of utilising it are being very fully investigated at the Imperial Institute. In view of the observations which have been made so far, it seems not improbable that the lignite deposits of Southern Nigeria may prove a valuable asset not merely for the Colony, but as a source of fuel for the whole of West Africa. A series of clays from Southern Nigeria has also been fully examined to ascertain their value for the local manufacture of pottery by the natives.

In Northern Nigeria the mineral surveyors have, in addition to other work, located and explored new or little-known deposits of tinstone, which proved on examination at the Imperial Institute to be of excellent quality. There can now be little doubt that tin mining will become in the future one of the principal industries of this country.

In Nyasaland the location of deposits of excellent coal and also of graphite are among the more important results of the work of the mineral survey. One of the deposits of graphite is now being opened out by a firm of manufacturers with the advice of the Imperial Institute.

A detailed examination and a series of technical trials have been made of a large series of clays specially collected



in India with a view to ascertaining their value for the local manufacture of pottery.

A most interesting series of specimens of tin ores were received for examination from the Federated Malay States, in which the tinstone was deposited in limestone; the latter proved sufficiently phosphatic to be of value as an artificial manure.

Reports on the results of the mineral surveys in Northern Nigeria and in Nyasaland have been issued as Parliamentary Papers during the year.

---

## GENERAL IMPRESSIONS OF A VISIT: TO CEYLON, SINGAPORE, AND FEDERATED MALAY STATES IN RELATION TO THE FRUIT TRADE.

BY MR. A. H. BENSON.

(From the *Annual Report of the Department of Agriculture and Stock, Brisbane, Queensland.*)

Having received instructions to break my return journey to Brisbane and proceed to Singapore to enquire into the pineapple canning industry, I left England on 16th October, and proceeded to Colombo, where I arrived on 9th November and remained to 12th November, when I continued my journey to Singapore, which was reached on 18th November. The primary object of my visit was to obtain full particulars respecting the pineapple canning industry; and to obtain this information I visited all the canneries that were working at the time of my visit, as well as all the most important of the pineapple plantations in the Island of Singapore.

The result of my enquiries have been submitted to you in two reports, one dealing with the matter from a general standpoint, and the other more of a private nature, in that it dealt with matters of interest only to the trade. A copy of this latter report has been sent to all who are engaged in this industry, and the information I was able to give has been appreciated.

Although the main object of my visit was to find out all I could about the pineapple industry, I missed no opportunity of acquiring information respecting the growing of tropical crops, and it is with such of these crops as may be suitable for growing in the more tropical parts of the State that I purpose dealing in this report.

In the first place the climate of Singapore is a remarkably equable one, the temperature during the time of my visit ranging from 80 degrees to 84 degrees F. day and night. Rain falls at frequent intervals, usually in the afternoon, and the atmosphere is saturated with moisture. The consequence is that, although the soil is by no means rich, vegetation of all kinds is extremely vigorous, and many tropical products are grown to perfection. The Island of Singapore has a population of some 280,000, the bulk of whom live very largely on fruits, vegetables, and fish. There are several fine markets that are kept remarkably clean, where all kinds of fruits (both fresh and preserved), vegetables (fresh and dried), fish (fresh and dried), butcher's meat, poultry, &c., are sold. Of fruits there are many unknown or only little known, to this State, as well as many with which we are acquainted. Of the former, the commonest in its season is the Durian (*Durio zibethinus*), a fruit that is greatly appreciated by the natives and some Europeans, but has the great drawback of possessing the most disgusting odour; an odour that must be overcome before one can appreciate the excellence of the fruit. The fruit weighs from 5 to 7 lb., has a hard skin and is covered with long, hard, sharp prickles. The flesh is of the consistency of sour cream, and, when one can overcome the smell, is palatable, though it is not a fruit that I hanker after. It will grow in Ceylon up to an elevation of 1,500 ft. above sea-level, and it is, therefore, probable that it could be grown successfully on the Daintree, Bailey's Creek, or Bloomfield districts.

THE JACK FRUIT (*Artocarpus integrifolia*) is grown extensively, and is consumed in large quantities by the coloured population. It is usually sold in an unripe condition, and is used for cooking rather than for eating raw. There are two types of the fruit, known locally as Nangka and Chumpada. The former is similar to the Jack Fruit grown here, but the latter is shaped more like a vegetable marrow, and is considered the better variety.

THE MANGOSTEEN (*Garcinia Mangostana*) is at home here, and is one of the commonest fruit trees. Its fruit is very highly flavoured and very refreshing, but unfortunately the area in which it can be successfully grown is very limited, and attempts to introduce it into Queensland have not been successful.

THE SAPODILLA PLUM (*Achras Sapota*), the Sheko or Chikus of the Malay, is a fruit that should do well with us. It is a fine flavoured fruit, when fully ripe, somewhat resembling a good pear. It is a curious looking fruit, in fact it is more like a potato than a fruit.

THE RAMBUTAN (*Nephelium lappaceum*) and the Pulasan are two fruits of the Litchi family that should thrive on the coast to the north of Cairns. The Rambutan bears clusters of bright red round fruit, covered with soft spines, and the edible portion is the white aril surrounding the seed. There is certainly not much that can be eaten, but the flavour of what there is is extremely good.

EUGENIA SPP.—The fruits of several species of Eugenia, including the Wax Jamba, the pear-shaped Jamba or Malay apple, the Rose apple and Brazilian cherry are common. The term Jamba is applied by the natives to both Eugenias and Psidiums (Quaras). In addition to this there are a number of fruits that are well known to most Queenslanders, such as the coconut, betel nut, flaucostia, vi apple, bananas of many kinds, pineapples of several kinds, bael fruit, papaws of several types, pomilos, wampu, arerchoa, anona, tamarind, alligator pear, monstera-granadilla, &c.

The coconut is largely used both in its ripe and unripe state, coconut oil, &c., and is grown in enormous quantities. The nuts vary very much in size, and there are several types of trees. I have already submitted a report on coconut-growing, as I am of the opinion that a large area of north-eastern tropical seaboard is well adapted for the growth of this plam.

Of bananas there are many species (some 70), some of which are used ripe as fruit, but many are used solely for cooking. We have as good eating sorts here as in the East, as their best fruits are of the sugar and lady's finger types.

Of pineapples, practically only one variety, a smooth-leaf, is grown. It is a distinct variety to the smooth-leaf Cayenne grown here, and is decidedly inferior to it in flavour. It is a very solid pine, and cases well, but when canned is lacking in flavour. In my report on pineapple canning I have already gone carefully into the question of varieties and the methods of culture employed, so there is no need for me to repeat what I have already written.

Papaws are good, the long type, known as "Madagascar" in Ceylon being the best. This is practically the same fruit as the "Couley" papaw of Queensland.

Of the miscellaneous fruit there is nothing special to report, as they are practically the same as those grown here.

As previously stated, fruit and vegetables form a large part of the staple food of all classes, and, this being so, I am of the opinion that there is a good market for these fruits, which we can grow, but which cannot be grown in equatorial countries. When at Singapore I noted large numbers of oranges, mandarins and persimmons on the market. These were not local productions, but were imported from China. There is a good demand for citrus fruit, as shown by the fact that during the last quarter of 1907 and the first quarter of 1908, no less than 291,509 dollars worth of fruit was imported from China, the bulk of which was citrus. During the second and third quarters of 1908, the off-season for citrus fruits in China, but the season for our fruits, only 37,044 dollars worth of fruit was imported from China. From these figures it will be seen that there is a large market for our oranges and mandarins in Singapore from April to September. There is no cold season, and citrus fruits meet with a ready sale at all times.

I am also of the opinion that we can obtain a good market for good apples, and prime fleshed peaches and plums from the Stanthorpe district. We should have no difficulty in landing our fruit in good condition, provided that extra care is taken in packing, and that suitable cases are used, as cold storage is available on the steamers that trade direct from Brisbane to Singapore.

In addition to fruits, there is a good market for first-class vegetables of European varieties. There are any quantities of vegetables grown locally by the Chinese, but they are unable to produce a good onion, cabbage, or potato, and these vegetables would meet with a good sale at any time.

There are many kinds of locally-grown vegetables, some of which should be grown here to a much larger extent than they are, viz., the different kinds of Brinjals or egg fruits, the lady's finger, or landacoy, a species of Okra, both of which are excellent both in curries and as vegetables.

### ECONOMIC PRODUCTS.

Rubber is the one product talked about throughout the Malay Peninsula, and it is estimated that on 1st January, 1907, some 10,000,000 trees had been planted, and since then the number has been considerably increased, and it is thought that an area of not less than 100,000 acres will shortly be under crop.

The variety planted is almost exclusively Para, the seeds of all the fruit plantings being obtained from the old trees growing at the Singapore Botanic Gardens. The oldest trees were obtained from Kew in 1879, and the largest tree is now 3 ft. in diameter, 4 ft. from the ground. The bulk of the plantation was, however, set out in 1884, and these trees yield an average of 6 lb. of rubber per tree.

They were planted very irregularly, some trees being not more than 4 ft. apart, whilst others are 12 ft. or more apart. There is still a difference of opinion as to the right distance apart at which to plant, but from 15 to 16 ft. seems to be the most general.

Rubber is by no means a cheap crop to grow, as it is estimated that by the time a plantation comes into bearing, the cost of the land, preparation, planting, and maintenance amounts to about £20 to £25 per acre, so that considerable capital is required to go in for a large area. The land must be kept clean round the young trees, for the first few years, and where lalang (blady grass) is present, this is a serious item in the cost of establishing a plantation. The trees are tapped at from 5 to 6 years of age, the herring-bone system being commonly employed.

In addition to Para several other rubber-producing trees are grown to a small extent, including Rambong (*Ficus elastica*); *Funtumia elastica*, much like Para, but a slower growth; *Manihot glaziovii*, said to be hard to tap; *Castilloa elastica*, subject to injury by borers, and a very irregular grower; but the one variety grown in quantity is Para.

TAPIOCA.—*Manihot utilitissima*, Cassava, is grown in large quantities in the Federated Malay States. It is found to exhaust the soil very quickly, seldom more than two crops being taken off the same land. It thrives best in a free soil. On no account must it be grown between young rubber trees.

CITRONELLA.—Thanks to the courtesy of Mr. D. R. Conan, of the Perseverance Estate, Singapore, I was able to make an inspection of a Citronella plantation and factory for extracting the oil.

Citronella is obtained from a strong-growing grass, a species of Andropogon. The method employed for its culture is as follows:—The land, a damp sandy loam, with water 2 to 3 ft. from the surface, is first well worked to get into a fine tilth, and to get rid of weeds and

blady grass. It is then planted, the method of planting being to set three small plants (obtained by breaking up an old stool) about 8 in. apart in triangle form, such hills or clumps of young plants being about 2 ft. 6 in. apart each way. The cultivation subsequent to planting is all done with a hoe, and is simply to keep down weeds. At six months of age the crop is harvested, subsequent cuttings being made at intervals of four months. The grass is cut by hand with a hook, and when cut is gathered into a bunch and placed on the top of a stool to wilt for three or four days, when it is carted to the factory and the oil extracted from it by distillation. After the extraction of the oil, the grass is readily eaten by stock. But they will not touch it in the green state. The grass is a shallow rooter, and as it grows forms quite a stool on the surface of the ground. When manuring is necessary, the manure—cow or horse—is placed on the top of the centre of the stool in a similar manner to what is known as centre manuring of pineapples in Queensland.

The crop is not a difficult one to grow, and is one that is worth trying in the North, as there is a good demand for the oil.

In addition to Citronella, there was a little lemon grass, *Andropogon Schoenanthus*. This is grown and treated in a similar manner, but is distilled separately, as the oils are quite distinct and of different values.

An important industry in Malayia, Sumatra, and Java is the manufacture of Kutch, a tanning material obtained from the bark of a species of mangrove locally known as Tingal tree (*Ceriops candolleana*). It is an excellent tanning material, and is probably identical with the Kutch of Java and Sumatra.

Whilst in the Malay Peninsula I obtained considerable information and assistance from several gentlemen, including Mr. Alex. Gunn, Secretary of the Chamber of Commerce, Singapore; Mr. T. W. Main, of the Botanic Gardens, Singapore; Mr. Fox, of the Botanic Gardens, Penang, and several other public officials. I left Penang on the 5th December, and returned to Colombo, where I arrived on 10th December, and proceeded to Kandy. Whilst at Kandy I paid two visits to the Royal Botanic Gardens, Peradeniya, and was shown round the gardens and experiment plots by Mr. R. H. Lock, the Assistant Director. The gardens and experiment station embrace some 700 acres, so that there is ample scope for carrying out experiment work on a commercial scale. The gardens are very fine, and contain a good assortment of economic and ornamental plants and trees, including a great collection of tropical fruits. The part, however, that interested me most was the experiment work, which included cultural and manurial experiments with various crops, testing of new varieties of economic plants, treatment of plant diseases, &c.

Cocoa is grown extensively, and some very interesting experiments were in progress at the time of my visit. These experiments consisted, in the first place, of manuring with various commercial fertilisers, as the soil, which is a poor sandy loam, is found by analysis to be deficient in humus and all essential plant foods. The results of the experiments up to the date of my visit were somewhat confusing, and no definite results had been obtained. The yield varied from 3,000 to 10,000 pods per acre in the different plots, but this is not considered good, as it takes 2,000 pods to produce one cwt. of dry beans, and a good crop should give at least half a ton to the acre. A really good crop should average 100 pods to the tree, and with 225 trees to the acre this gives 22,500 pods, but this result can only be obtained by careful cultivation and the right shading.

The shading of cocoa trees is a very important matter, as if the shading is too dense the trees are attacked by fungus, and if it is too sparse the pods are seriously injured by a sucking bug.

The trees are usually planted 15 ft. by 15 ft., and are shaded by Dadap trees (*Erythrina indica*), which are pruned when necessary, and the prunings allowed to lie on the ground and rot for manure, as the Dadap is a nitrogen gatherer, and acts in a similar manner to the leguminous plants that we grow for green manuring.

Proper pruning and shading have produced more beneficial results than manuring, and forking the ground has proved detrimental, purely surface working having the best effect. In future experiments the ground will be thoroughly prepared prior to planting, and it is probable that manuring under these conditions will have a marked effect. From what I saw of cocoa cultivation here and in the Kandy district generally, I am of opinion that cocoa can be grown successfully in the Daintree, Bailey's Creek, and Bloomfield districts. Care will have to be taken to obtain the best kind of cocoa, as there are several varieties that vary considerably in the growth of the tree, productiveness, and

quality, and if its cultivation is to be a success here we will have to grow the variety that suits our local conditions best.

Rubber is also being largely experimented with, and the following varieties are being tested: –

PARA.—So far this is proving most satisfactory, and many millions of trees of this variety are being planted throughout the island.

*Funtumia elastica*: West African rubber, is not doing too well, the plants being liable to the attack of a leaf-eating insect which completely defoliates them, and in some cases kills the tree outright.

*Castilloa* is doing well as far as growth is concerned, but is found hard to tap.

A new species of rubber, known as Manicobar (*Manihot dichotoma*), a native of Brazil, is showing considerable promise. It is said to stand dry weather better than Para, and on the poor land on which it was growing it was making good progress. The oldest plants at the nursery were only eighteen months old, but were already 10 ft. high, and had set a small crop of seed. A young plantation of this variety has been set out 12 ft. by 12 ft. and 12 ft. by 6 ft. This is a variety of rubber that should be tested in this State, as if it proves to be able to stand dry weather better than Para, it will be a more suitable variety to grow.

TEA, one of the staple industries of Ceylon, receives considerable attention, and many experiments are being conducted in manuring and pruning. The most satisfactory manure is to green manure with a species of *Crotalaria*. Lemon grass, citronella grass (two species), cocaine, croton oil, tobacco, and many other tropical plants are being tested and experimented with on commercial lines; in brief, the work that is being carried out at Peradeniya is some of the most important and interesting that I saw; and the results obtained by the experiments that are carried out there will be of considerable value to us.

Most of the fruits that are grown in the Federated Malay States are grown in Ceylon; bananas, coconuts, and papaws being very plentiful. Rice is the staple food crop of the natives, and is grown from the flat swampy country near the coast to hillsides at a considerable elevation. The hillside cultivation is simply marvellous, as the whole face of the hill is terraced, the terraces, often only a few feet in width, following the contour lines of the hill. The whole is irrigated, the water entering at the top and passing from terrace to terrace till the whole hillside is flooded, a feat in irrigation engineering that it would be hard to beat in any part of the world. I thought I had seen a little irrigation in California and other parts, but I have to admit that the Sinhalese coolie cultivators opened my eyes by the manner in which they irrigated a steep hillside from top to bottom.

Ceylon produces a few citrus fruits, but they are of inferior quality, and I think it possible that a small market for really first-class fruit could be obtained. However, we are in a bad position with regard to Ceylon, as to get there our fruit has to go all round the Southern coasts of Australia, whereas we can ship practically direct to Singapore, so that I consider that the latter is the best market for us to go for.

I left Ceylon on 21st December and reached Brisbane on 14th January of this year.

---

## GREEN DRESSINGS AND THEIR APPLICATION.

### II. THE EFFCT ON THE SOIL.

(From the *Agricultural News*, Vol. VIII., No. 190, p. 241, August, 1909.)

In cases where the plants which are intended to provide green dressings are to be turned into the soil on which they are raised, as is the common practice, the first effect which has to be considered is that arising from the circumstance that they have been grown on that soil.

Under favourable conditions, the burial of plants of any kind will add humus to the soil, thus improving the tilth, with the well-known additional benefit, in the case of legumes, of the increase of its nitrogenous content. There are instances, however, where the special circumstances surrounding the raising of the crop prevent the acquisition of these benefits. In a light, open soil having a small water-holding capacity and liable to suffer from drought, the lowering of the water-content may act so disastrously on the succeeding crop as to make it impossible for it to attain a condition in which it may benefit by the presence of the additional plant food which has been provided for it. Then, too, repeated raising and ploughing-in of green manures on the same soil, as the sole attempt to keep it in condition, will lead to the temporary

exhaustion of its mineral constituents, as will be explained later. Thus must the general history of a soil be considered first, when the question of the application of green dressings is under debate and, in the event of a favourable conclusion being arrived at, what follows here is then, and only then, a matter that can have relation to that particular soil.

Turning, now, to the effects of the buried plants on the soil, the subject may be viewed conveniently from the aspect of the uses of such plants when they are applied in this way. These uses may be grouped under two heads: that of the prevention of the loss of plant-food already present, and that of the provision of additional plant food.

In the first connexion, it may be remarked that the very important effect of green dressings in preventing the loss of useful soil constituents is very often given much less recognition than it deserves. It is well-known that nitrates, owing to their solubility, are very likely to be lost in drainage water, and that the prevention of such loss is a matter of supreme importance to agriculturists. Green manures are especially efficacious in this direction, for they take up those bodies and form stable combinations with them, which are subsequently rendered available by bacteria in the ordinary way. A similar action takes place in regard to other food-constituents, such as phosphoric acid, potash and lime; not, however, because, like nitrates, they are liable to be lost in the wash-water, but because the green dressing unites with them in such a way as to render them more directly available. These maintenance effects follow the use of any kind of green dressing, but they are augmented, in the case of leguminous plants, by the fact that the presence of the latter helps to lessen the number of those organisms which cause soils to lose nitrogen.

The second use of the practice which is under consideration, that of the provision of plant food in addition to what is already existent in the soil, is one which, so far as has been satisfactorily demonstrated up to the present, solely connected to the ability of leguminous crops to add nitrogen to the soil. It is not the purpose of this article to deal with this aspect of the subject; if further information is required, attention is directed to the recent one on Soil Inoculation, *Agricultural News*, Vol. VIII., No. 184, of May 15, 1909, to which reference has already been made. It will not be out of place, however, to draw attention, at this stage, to the influence of former leguminous crops on the later ones. The fact that a soil has already had the benefit of nodule nitrification hastens succeeding efforts in this direction, for the reason that such a soil already contains an amount of nitrogen sufficient to stimulate plant-growth, and because the fact that nodule bacteria have already been raised in it hastens the infection of the later legumes with those useful organisms.

The kind of soil to which green dressings are applied must, naturally, be an important factor in regard to the results on such application. The action in light, open soils must be very different from the one which will take place in those which are heavy. Their effectiveness is generally far greater in the former case than in the latter. The lack of plant food in sandy soils, their openness, their small capacity for holding water, and their lack of humus all contribute to the great change for the good which often follows the application of plant-material. There is certainly the fear that, in well-watered soils of this kind, acidity may result from the practice; but this tendency may be controlled by judicious action in the matter and by the use of lime as a corrective. It is quite another matter in the case of heavy soils. These do not require applications of green dressings as often as they are demanded by the lighter ones. They hold water well, the activity of the bacteria which cause decay is smaller, they retain nitrates to a much greater degree, and, under good conditions of drainage are much less likely to suffer a loss of nitrogen from the action of bacteria. None the less, such applications are eminently desirable from time to time, because they have the effect of quickly freeing otherwise slowly accessible stores of potash and phosphoric acid, and because of their improvements of the condition of the soil.

Sufficient has already been said to indicate that care must be exercised in the use of green dressings. Damage to the soil will obviously cause harm to the plants which such dressings were intended ultimately to benefit. By what criteria shall we chiefly judge in particular instances, whether benefit or harm will accrue? The answer is, as has been stated differently already: By those in which the first consideration is given to the conditions regulating the bacterial life, both in the buried plants and in the soil.

## POTASH—A MANURE FOR ORCHARDS, VINEYARDS, AND GARDENS.

By Albert H. Benson, M.R.A.C.

(From the *Queensland Agricultural Journal*, Vol. XXIII., Pt. 3, September, 1909.)

The value of potash as a manure for orchards, vineyards and gardens is only now beginning to be recognised by our Queensland growers. It has been used in small quantities, generally in the form of a mixed fertiliser, for some years; but it is only recently that it is being used systematically.

The reason for this I will deal with later on, as, in the first place, I wish to show the important part that potash plays in the growing of fruits and vegetables. If one makes a careful study of the analyses of the ash of the principal commercial fruits and vegetables, one cannot fail to be impressed with the important fact, that potash forms a very large percentage of the ash; in fact, so much so, that it may be said to be the dominant ingredient of the ash. Potash is usually present in the largest proportions in the ash of fruits, roots, and pulses, but it is present also in large quantities in the ash of wood, leaves, and roots of fruit trees and vines, and in the roots and foliage of vegetables.

In the case of the ash of fruits, the average potash contents for all commercial fruits amount to nearly 50 per cent. of the total weight of the ash. Some fruits, notably stone fruits, run considerably higher, in some cases the potash amounting to 70 per cent. of the total ash.

This being the case, it seems at first sight an extraordinary fact, that so far we have used such a small quantity of potash as a manure; especially when we take into consideration the fact, that many of our soils are by no means rich in this essential plant food, particularly so in a readily available form.

How is it then, one may ask, that we have been able to grow such good crops of fruits and vegetables for years past without the application of potash manure; and why is it now necessary to apply such manures in order to keep up the yield of fruit or vegetables? The answer to those questions is, that the bulk of the land on which we are growing fruit is virgin land, and that this land has, up till the present, shown little signs of deficiency in available potash. In other words the available potash in new land, particularly when there has been a heavy growth of forest or scrub timber burnt off, has been sufficient to produce good returns, in some cases for several years, and it is only now that this available supply is becoming exhausted by the heavy crops of fruits or vegetables that have been taken off the land that we are beginning to find out the value of potash as a manure.

There is one very noticeable feature in manuring with potash, and that is, it is only when the supply of available potash in the soil is exhausted or seriously depleted that we see the beneficial effect of manuring with potash. This accounts for those cases when it has been found that the application of potash has had apparently no effect, as where there is a sufficiency of available potash in the soil for the proper development of the crop, the addition of an extra supply of potash has had no effect. In these cases the grower has been disappointed, and has even gone so far as to say that potash is no good as a manure. The fault has not been with the manure, but that the soil was already sufficiently rich in this plant food. The question now arises, how is the grower to tell when his land requires potash? This can only be answered by an analysis of the soil, or, better still, by a little experimenting on the part of the grower. A few pounds of sulphate of potash applied to a row of English or sweet potatoes, or to a patch of tomatoes, will soon show the grower if his land wants potash, as, if in want of this plant food, the results of the manure will be very evident.

The total amount of potash contained in a soil, as shown by analysis, is often very misleading, as it is only that portion which is soluble or readily available that can be utilised by the plant. The bulk of the potash in the soil is in an insoluble form that only becomes slowly available. This is clearly shown in the case of the soils in the Stanthorpe district. Here the bulk of the soils are formed by the disintegration of the granite rocks for countless years. The granite is rich in felspar that contains from 7 to 8 per cent. of potash, yet once the available potash in the soil is depleted, the addition of a potash manure to the soil has a very marked effect in the production of potatoes, tomatoes, carrots, pulses, and of all fruits.

Another instance of the necessity of having a sufficiency of available potash in the soil, is clearly shown by the analyses of some banana soils from the Liverpool Creek district, North Queensland. Two soils were selected, one on

which bananas had been grown for some six years and then abandoned, and the other virgin soil about to be planted in bananas. The two soils were for all practical purposes identical, and a complete analysis showed very little difference between them in the total amount of potash; but a second analysis, to determine the available potash, showed that the virgin soil contained five times as much as the land on which bananas had been grown and given up.

As a further instance of the necessity of having a sufficient quantity of available potash in the soil I can quote the experience of a large pineapple-grower on the North Coast Line. The soil on which the pines are growing is deep sandy loam, that was originally covered with a growth of timber which was burnt off on the land.

For the first five years the pines made a good growth, and gave good returns without any manure. They then began to go back, and were manured with meatworks manure (phosphoric acid and nitrogen), and the results were still satisfactory for some time. Finally, they again showed signs of going back even though they received a greatly increased dressing of meatworks manure. The pines had depleted the supply of available potash, and, consequently, owing to the want of potash, the meatworks manure failed to act. This was clearly proved by the addition of potash to the land as the pines responded at once, and produced a heavy crop of excellent fruit. Previous applications of potash to this land had, apparently, no result; and it was only when the available potash was depleted that the addition of potash as a manure had such a marked effect.

When land is deficient in available potash as shown either by analysis or by the simple tests that I have recommended, the addition of potash as a manure for all kinds of fruits and vegetables will have a very marked effect, and is one of the best investments the grower can make. I am often confronted by the grower saying, that potash is such an expensive manure, it costs £14 or £16 a ton; true, yet a ton of high-grade sulphate of potash contains about 50 per cent. of pure potash, or, in other words, 100 lb. of sulphate of potash contains 50 lb. of pure potash, and, at the higher rate of £16 per ton, this works out at only 3½d. per lb., which is about the same price per lb. as one has to pay for phosphoric acid, and only about one-third of the price per lb. one has to pay for nitrogen.

Sulphate of potash is a concentrated manure, and is the cheapest form in which to buy potash, especially when the question of railway or steamer freight and cartage is to be considered.

---

## CO-OPERATIVE CREDIT IN BENGAL.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 9, September 1, 1909.)

In an admirable article published by the *Bengalee*, the evil effects of absentee landlordism upon village economy were forcibly demonstrated. To this indictment of those zemindars who live in a grand style in Calcutta and leave their tenants to lead a miserable existence in villages haunted by malaria and cholera no serious reply has been attempted. It has indeed been argued by a correspondent who is himself, it would appear, a zemindar, that the landlords have no more obligations towards their tenants than any educated man has towards the uneducated. Whether this cynical repudiation of responsibility represents the general view among absentee zemindars we have no means of knowing, but it is certain that those who cherish the notion that their sole duty is to levy rents from their tenants and spend the money where they please and as they please, are harbouring mediæval ideas which will lead to a rude awakening before long. The day will come when they will be asked to justify their existence which, so far as we can see, serves no useful purpose. There is, however, another class of absentee landlords who without denying that they have certain obligations towards the ryots on whose earnings they live, plead that their own health should form their first consideration, and that they can look after the interests of their tenants more efficiently at a safe distance from insanitary villages. "It is hopeless," says the *Hindoo Patriot*, "to except any energetic action from a zemindar who is a prey to malaria or any other malady, because, under the circumstances, he cannot bring himself to give attention to anything else but his own interest. But when he enjoys good health he feels for those who are not similarly blessed." A sympathetic feeling is an excellent thing, so far as it goes. But sympathy at a distance is not what is wanted. The decay of village life cannot be arrested by the compassion of a zemindar class residing in Calcutta. If the villages are to be made more healthy, to be provided with pure water, and to be delivered from malaria,

the people must be shown what ought to be done, and inspired to do it,. by educated men who live among them and who exercise the influence inseparable from the wealth and status of a zemindar. Not only the vital economy of the villages but their prosperity depends upon the presence in their midst of enlightened men who realise that it is their duty to render public service to the people,not in Calcutta, but where the people live and toil. Of this fact we are reminded by the Resolution of the Government of Bengal on Co-operative Credit Societies, which appears below. These societies form, as every one who has given any attention to the subject knows, the most perfect organisation ever devised for delivering the peasantry from crushing debt and enabling them to win their way towards financial freedom and the new courage and hope which independence brings. Such societies have been establised in Bengal and have achieved excellent results. The number of Societies, urban and rural, has risen to 395 with 14,640 members, showing an increase of45 societies and over 2,540 members during the year. The capital invested in them now amounts to Rs. 3,65,086. The most interesting and important feature of the movement,however, is the growth ot the rural societies of which there are 359. But owing to this gratifying expansion, "the development of co-operative credit in the Mofussil," says the Resolution," has reached a critical stage." The success of the societies depends on careful supervision, but the number of societies being what it is, the Registrar and his assisstant are unable to visit each society more than once or twice a year. Yet the need for more societies is, as all must perceive, urgent. A few hundred sccieties cannot possibly do more than touch the fringe of the indebtedness of rural Bengal. The circumstances are such as should make an irresistible appeal, especially to the zemindars, the natural leaders of the rural community. "The real work of forming societies and educating the members, says the Resolution, " must devolve on local voluntary helpers, and the Lieutenant-Governor agrees with the Registrar in the opinion that, unless and until it is adopted in earnest by the people themselves, the movement will be confined within the very definite limits of a kindly but ineffective official experiment." This pronouncement is a grave reflection upon the amount of genuine public spirit in Bengal and especially among its zemindars. Germany could produce its Raiffeisen who redeemed a poverty-stricken peasantry from debt, but in Bengal a movement which has been given the advantage of a start by the Government is crippled in its progress by the lack of men who are prepared to give a little time and trouble for the salvation of the ryot. In the light of the explanation given by the *Hindoo Patriot*, the main reason for this failure is that a large number of the zemindars regard it as a sacred duty to stay in Calcutta and nurse their own health. The peasant is left to cholera, malaria, and debt.



---

### GOVERNMENT RESOLUTION ON LAST YEAR'S REPORT.

The following Government Resolution on the annual report on Co-operative Credit Societies in Bengal during 1908-09 is published as a supplement to the *Calcutta Gazette* :--

The report deals with the working of Co-operative Credit Societies for a period of nine months only, because in place of a year ending on the 30th June it has been decided to adopt the ordinary financial year ending on the 31st March. Throughout the year Mr. Buchan held the post of Registrar and Babu Jamini Mohan Mitra that of Personal Assistant. The report was written by the former officer before his departure on leave in April last; and the latter officer has prepared and reviewed the returns.

2. Since the passing of Act X of 1904 progress in Bengal has been along very simple and uniform lines. No attempt has been made to experiment with different forms of rural societies, and attention has been concentrated on the Raiffeisen type only. The earliest societies were disconnected units, formed sporadically where opportunity offered. Subsequent additions were in many cases due to the exertions of individual organisers of the older societies, whose personality served as a connecting link between them. This year a further step has been taken, and such groups of societies have been combined in self-administered unions. The policy has been followed of developing compact areas in each district and extending from these as centres, with the object of avoiding the waste of power which would follow from the dissipation of attention over single scattered societies.

3. The societies in Bengal are of two types. In the first the liability is limited, and for the most part the societies are urban; in the second the liability is unlimited and they are rural; and it is this second class which demands the particular attention of the Registrar.

4. During the past year the number of societies in the Province has risen from 350 to 395 or by 13 per cent. The membership has increased from 12,094 to 14,640 equivalent to 21 per cent., while the capital has risen from Rs. 2,25,437 to Rs. 3,65,086 or by 62 per cent. All the town societies have made considerable strides during the year. There has been no large increase in their number; but the co-operative spirit in them has developed greatly. Confidence is now thoroughly established, and they are financed almost entirely by share capital and the deposits of their members. It is anticipated that this form of co-operation will spread without much further assistance from the Registrar amongst the mercantile firms in Calcutta and the Government offices throughout the Province. A new form of society of an interesting type has been formed under the patronage of Sir Daniel Hamilton with the object of reclaiming waste lands in the Sundarbans. The joint capital will be employed in clearing the jungle and raising embankments, and the society will make advances to its members to enable them to cultivate the land and to settle tenants thereon. The progress of this society will be watched with much interest.

5. The development of co-operative credit in the mofussil has reached a critical stage. There are now 359 rural societies, being an increase of 33 during the year, and the Registrar and his Personal Assistant are no longer able to do more than visit each society once or perhaps twice in a year. It is on efficient control that the success of the existing societies hinges, and their future prospects depend upon the ability of the Registrar to evolve a satisfactory system of control.

6. The real work of forming societies and educating the members must devolve on local voluntary helpers, and the Lieutenant-Governor agrees with the Registrar in the opinion that unless and until it is adopted in earnest by the people themselves the movement will be confined within the very definite limits of a kindly but ineffective official experiment. During the past year the press has given a small measure of increased attention to co-operation, and there are signs that some who have it in their power to assist are beginning to realise the possibilities for good which the movement possesses; but on the whole evidence of popular interest has been disappointing. The second condition of any substantial success is the creation of some higher form of organization. During the year the Registrar has given his attention to this problem on the lines laid down at the last Conference of Registrars, when it was decided to aim at federation into unions on a joint stock basis. In such unions societies are to be the only shareholders, and the unions will be restricted to dealings with their shareholders only. Two such unions were formed during the year, one at Raruli in Khulna and the other at Khelar in Midnapore. In the opinion of the Registrar the progress made so far is encouraging; and the experience gained tends to prove that the combination of societies into unions is not only theoretically sound, but is also quite practicable in existing circumstances in Bengal. The Midnapore union has already become financially independent of the help of the Registrar, and can now secure funds locally without any difficulty.

7. The sources from which the working capital of the societies is obtained are analysed in paragraph 8 of the review of the statistics. Only 4 per cent. of the capital has been advanced by Government and the Court of Wards, 21 per cent. has been advanced by large zemindars to societies among their raiyats (the larger part by the Maharaja Bahadur of Darbhanga); while 48 per cent. has been invested by the outside public. The amount of capital invested by the members and the local public is still very small, amounting to only 13 per cent. The Registrar should do all he can to encourage members to deposit, and his opinion is approved by Government that it would be well to widen the basis of membership so as to take in some of the more well-to-do villagers, provided that this can be done without pressure from outside. While the success of a society cannot be judged entirely from the amount of money deposited by its members, the fact that they have a stake in it greatly increases its stability and its attraction for local capital.

8. The analysis of the purposes to which loans taken from societies have been applied is of interest. Repayment of debts accounts for 37 per cent., cultivation and the purchase of cattle for 36 per cent., and marriage expenses for only 1·4 per cent. It would appear, therefore, that it is a sound principle to leave to the discretion of the panchayat the purpose for which loans can be given. The important distinction is not between productive and unproductive expenditure, but between expenditure which is necessary and that which is not; and the panchayat is the best judge of what is necessary.

9. The experiment was continued of trying to employ the large grain *golas* of the Sonthal Parganas as central agencies for villaage rain societies, and appears to have met with a moderate amount of success. The Registrar is probably correct in holding that village grain banks will be successful only if kept on a small scale, and that as their utility is limited, they will tend as soon as they are successful to develop into cash societies.

10. The Lieutenant-Governor desires to acknowledge the energy and tact displayed by Mr. W. H. Buchan, the Registrar, and his personal Assistant, Babu Jamini Mohan Mitra, in the performance of their duties, and to acknowledge the work of the officials referred to by Mr. Buchan in his report. To the honorary organisers in particular his special thanks are due, both for what they have accocomplished, and still more for the example they have set to others in a work of which the ultimate success is dependent on the self-sacrifice and enthusiasm of private individuals.

---

## SOME COMMERCIAL CROPS OF INDIA.

(From the *Indian Trade Journal*, Vol. XIV., No. 179, September 2, 1909.)

The Proceedings of the Conference of the Board of Agriculture in India, which assembled at Nagpur in February last, have now been published and will be read with interest by those concerned with the agricultural products of this country. The cultivation of cotton is now receiving extended attention in practically all countries capable of producing that fibre; and, as might be expected, cotton occupied a prominent place in the programme of the Board, the idea being to make special investigations into the distribution of Indian cotton in the field throughout the country, more especially for the purpose of ascertaining exactly where the most valuable forms of each variety are grown, and to discover the possible natural forces which favour these; and, secondly, to substitute the superior varieties already discovered in place of the inferior varieties now grown in some tracts. This enquiry is now in full swing in almost all the Provinces and Presidencies of India, and is also engaging attention in some of the Native States. In the United Provinces, for example, we find that special steps are being taken to select for cultivation cottons that are noted for length and strength of fibre; the distribution of acclimatised American seed and the organisation of a market for the produce. In the Punjab a collection of the cotton grown there, as well as in the North-West Frontier Province, has been made and a botanical survey of this will be completed. Plant to plant selection and hybridising are to be continued, while some new Egyptian varieties are under observation. In the Bombay Presidency it has now been shown that Egyptian cotton can be grown with success in Sind at a good profit, and this fact is now to be demonstrated on a larger scale on the Jamrao Canal in order to induce the people to cultivate it properly. Upland American cotton is also to be tried in Upper Sind. The cultivation of Broach cotton is now an established success in the Southern Maharatta country, and Cambodia cotton promises well at Dharwar. Throughout the Bombay Presidency the improvement of cotton by plant to plant selection is being continued and efforts are being made to obtain a fixed type of cotton of superior quality. In Madras the cultivation of desirable cotton is being pushed to the front, and the seed of good varieties is being distributed on a large scale. Cambodia cotton has already found favour there, but the experiments now in hand are calculated to decide the best varieties for cultivation in the various districts of that Presidency. Cotton cultivation is also receiving a large deal of attention in the Central Provinces and Berar, where, amongst other scientific tests, the rotation of crops with cotton as the principal crop is determined. In Burma, too, the experiments recently undertaken with Egyptian cotton show promise of success. In Bengal, cotton is under experiment at Chaibassa where manurial and selection experiments on the *buri* variety are in progress. In short, the progress being made throughout the country seems to imply that the time will soon come when suitable varieties of cotton will be found for most of the cotton-producing districts in both India and Burma, and that this country's annual contribution to the world's cotton stocks should grow appreciably larger in the almost immediate future.

A matter of great importance to India, as we have frequently tried to show, is the cultivation of a good quality of sugarcane on a very much larger scale than has hitherto been practised; and we notice that this subject is given a liberal measure of attention by the Board. In the United Provinces important local varieties of cane are being tested with a view to determine some of the factors that influence the composition of the juice;

and the demonstration of Mr. Hadi's methods on sugar manufacture are being continued, not only in the United Provinces but also in the Punjab, where, we notice, it is proposed to start an enquiry as to the possibility of the introduction of more efficient cane crushing mills. In the Bombay Presidency the cultivation of sugarcane is being considered from almost every point of view and satisfactory progress is being made. In the Madras Presidency, Mauritius sugarcane, introduced by the Government Botanist, has almost ousted the local canes in the Godavari delta, and attention is now being mainly devoted to the testing of new varieties as well as to the introduction of the Mauritius variety of cane into other promising districts. In Bengal, the Central Provinces and Eastern Bengal and Assam the importance of the cultivation of good sugarcane is being borne prominently in mind. It would, therefore, seem that this important question has now been taken in hand in real earnest; and, although the day may be distant when India will be able to produce sufficient sugar to meet her own wants, much less become an exporting country, the steps now being taken by the various Directors-General of Agriculture to popularise sugarcane crops amongst the agriculturists are fairly certain to produce excellent results.

We do not propose to follow the Board through the large programme that engaged their attention. It will suffice to say that almost every crop grown in India came up in review before them. But the appendix dealing with the extension of the cultivation of fibre plants in India seems to deserve special mention. Here we are told that jute has replaced rice to a certain extent and, at first sight, this might be supposed to account in some measure for the ruling high price of that staple product. But the writers of the appendix hasten to add that the displacement of rice is more than compensated by the increase in the buying capacity of the country on the return of the more profitable jute crop. This fibre is now being cultivated more or less extensively in Assam, Behar, Madras, the Central Provinces and Burma. As to Burma, it is believed that the development of jute cultivation on a commercial scale will depend on the erection of a jute mill in Rangoon or other convenient centre; but the cost of labour in Burma, as compared with India, may, it is thought, form a serious commercial disadvantage.

Attention is drawn to the fact that Bombay hemp (*Hibiscus cannabinus*) would probably prove a profitable crop in many parts of India, where the climate is moist but not sufficiently so for jute. This fibre requires much less moisture than jute, and in this fact lies the importance of the plant. It is already cultivated in reveral provinces, but there would appear to be ample room for expansion at paying rates.

Another useful fibre is sunn hemp (*Crotalaria juncea*). This fibre does not compete with jute, as does that of *Hibiscus cannabinus*, but in market value it is superior to both. It is best grown in districts of moderate rainfall and, therefore, does not compete with rice. This crop is grown extensively in most parts of India and also in Burma, but not so much for its fibre as for its value as a green manure. In the Central Provinces the cultivation of this crop is said to be so profitable that it has been largely substituted for wheat, and the area sown with it has nearly doubled within the past few years. The cultivators say that the crop is a hardy one and that it improves the condition of the land. What is required to largely increase the cultivation of this crop in India is a cheap machine for extracting the fibre, as in many places retting is too costly.

The coconut fibre industry is practically confined to the southern portions of Bombay and Madras, where the cultivation of this palm is popular as it supplies food as well as fibre. In Bengal there are no large plantations. In parts of Eastern Bengal and Assam the coconut palm grows to perfection, and the Board consider that there seems to be no reason why this industry might not be introduced with profit into that Province.

There are, say the Board, possibilities of a useful industry in plantain fibre. Plantains grow practically all over India, and, besides, there are 124,000 acres under plantains in Burma alone, but nothing is done with the fibre although it can be extracted with a simple hand machine.

The appendix deals in detail with the other commercial fibres met with in India, but the prospects of those with which we have already dealt seem to be best worth immediate consideration.

---

## THE ECONOMIC VALUE OF A SCHOOL OF TROPICAL MEDICINE.

(From the *Tropical Life*, Vol. V., No. 10, October, 1909.)

Malaria is the most important of the tropical diseases, both directly, as it causes serious loss of labour, and in-

directly it predisposes to many of other diseases, especially some of those carried by water.

Water-borne diseases occur all over the world, and those so carried in temperate climates, such as typhoid fever, are also spread in the same way in the tropics, and, in addition, there are dysentery and, in some parts, cholera.

In all these cases the germs causing the disease are passed by the patients with their motions on to soil. In a damp soil some of them will multiply, others will remain quiescent. On a dry soil they may live for some time, and even be carried with dust by the wind. Sooner or later they may be carried to water, and when swallowed by susceptible individuals, particularly those with impaired digestion as so often occurs after malaria, the germs will rapidly multiply and give rise to an attack of the disease. Water-borne diseases such as cholera, typhoid and dysentery are therefore carried from man to man in drinking water.

This is not all, if it were, in order to prevent the spread of these diseases, it would be sufficient to destroy or disinfect the motions of all people suffering from these diseases. Unfortunately many persons will continue for weeks, months, or even years, to pass the germs in their motions, though they have completely recovered and show no symptoms at all. These persons have acquired immunity, and the parasites which they harbour are harmless to them, but wherever they go they deposit the germs, and if these germs get into water they will set up the disease in persons who drink that water. Such persons are known as typhoid, cholera, or dysentery "carriers," and in many cases have been shown to be the active agents in the transmission of these diseases.

Where possible the destruction of all motions is to be recommended, and burning in incinerators is the best method. Burial at a depth of some 18 in. is also satisfactory, but then there is the possibility of the drainage from the burial place entering the water supply.

The water supplies in general use on estates are large open ponds or tanks or superficial wells, in either of these cases the ground around such tanks or wells must be kept clear, and no buildings, native lines or latrines should be allowed within an area of 80 times the depth of the well from it. It must not be in a hollow, and no stream, drain, or other channel likely to be fouled with refuse from houses or any public place of resort should be allowed to run near it, as urine as well as the motions may contain the germs.

Deep wells, those which pass right through at least one impervious stratum of the soil are much safer.

All wells should have a raised parapet round them, and the ground should be cemented round so as to form a platform sloping from the well to a circular channel which collects water which is spilled or used in ablutions. If these precautions are not taken such water will run back into the well or tank, and contaminate it.

This is a special danger in places where the guinea-worm occurs. This worm when mature discharges its embryos if water is poured over the skin where the guinea-worm is protruded. These embryos, therefore, are found in the ablution water. It had been known for many years that these embryos only lived for a few days in water, but that if they entered a minute fresh-water crustacean—the cyclops—they lived for a long time and developed, but it was doubtful how they again entered man. Whether it was by bathing in water containing these infected cyclops or by drinking it; whether, in fact, the worm entered by the skin or by the mouth was the point in dispute. In West Africa, where in certain times of the year a large proportion of the labour is disabled from this cause, the matter was so serious that the London School of Tropical Medicine decided to send their helminthologist, Dr. R. T. Leiper, at a cost to them of several hundred pounds, to investigate. Dr. Leiper conclusively proved by experiments on monkeys that the guinea-worm entered their warm blooded host through the drinking water.

The correct form of prevention, therefore, is now quite clear, and the knowledge thus acquired was worth in saving of labour far more than the cost. If we succeed in preventing water used for ablution from being mixed with the drinking water, then infection with the guinea-worm is an impossibility. Separate bathing places are much to be desired, but even then a few people will drink the water, but those only will be infected.

If, on the other hand, the wells are properly protected and water used for ablution is not allowed to flow back into the wells, then the cyclops in the water will not be infected, and the people using these wells will be safe.

Boiling of the water before use will prevent most dangers, but from the

economic point of view it is the health of the labour force that has to be considered, and to boil all the water for their use is impracticable,

For Europeans it is different. They can ensure that water is first filtered and then boiled, but they must not rely on the filter, and must boil the water *after* not before filtration.

---

## PRESERVING BOOKS IN THE TROPICS.

(From the *Agricultural News*, Vol. VIII., No. 197, November 13, 1909.)

Mr. H. Maxwell-Lefroy, M.A., F.E.S., F.Z.S., Entomologist to the Government of India (sometime Entomologist to this Department), gives, in *The Eastern Printers' Yearbook*, several precautions against the destruction of books and papers by insects in the tropics. As some of these are comparatively new, the following extracts are taken from his article:—

The most destructive insect to books is the book beetle (*Sitodrepa panicea*). This is a small brown beetle, which is only one stage of this insect's life, the greater part of the destruction being caused by the small white grub, which is one of the earlier stages. The grub eats tunnels in the books, feeding upon the paper or binding, eating straight ahead through the pages, but always keeping inside; naturally it can feed undisturbed only in a book which is not in use, and it is in books that are left neglected on the shelf that this insect is found. The grub is white, with the head brown, and the body is clothed with short, brown hairs. It hatches from eggs laid by the beetle, and after some weeks of active life, transforms into the dormant chrysalis, from which, after a little time, comes the beetle. It is the beetle that starts the mischief, by eating into the book and laying eggs there, the grubs then continuing it. The insect is probably an introduced one, having been brought most likely in books or merchandise from Europe; it is common practically all over the world, and feeds not only in books, paper, cardboard, and similar materials, but in dry wood, in the cane that furniture is made of, and in dried foodstuffs.

Where books or papers are constantly in use, or being moved, the insect is not generally found; when it is found, there is only one radical cure, which is to go over all the books or stocks of papers and search out the insects; in bad cases of attack, where this is not possible, it is necessary to clear out all infested articles, clean the room thoroughly, and putting the articles in a tight box or cupboard, put sufficient carbon bisulphide or benzine in to thoroughly impregnate everything with the fumes, and kill the insects. At least one pint of the fluid used must be put into every 200 cubic feet of space, and it is necessary to keep the infested articles exposed for twenty-four hours, and to take precautions that no light is brought near while the fumes can be smelt.

The above procedure is necessary only with very bad cases; as a rule, it is sufficient to deal with each attacked book separately. Preservation is of course better than cure, and the general precautions suggested below are the best for this insect, as for others.

Another injurious insect is the common cockroach; the commonest cockroach in Indian houses is *Periplaneta australasiæ*, the big brown cockroach; but there are several other household species. These have a fondness for the colouring matter of cloth bindings, especiallyof certain reds and other tints; they feed at night and nibble off the surface of the binding, greatly disfiguring the books. The preparation given below is a certain preventive of damage; where cockroaches are, however, very plentiful, a liberal application of borax, or the provision of plenty of a mixture of borax (one part) and syrup (two parts), smeared thickly on pieces of card or tin and put under furniture and in dark corners, is a great check on their numbers. Borax is a specific poison to cockroaches and should be used freely.

We know of only one other class of insect injurious to paper and books; these are the curious shiny insects known as 'silver fish' which are so common in cupboards and in dark, dusty places. They cannot injure books or papers except by destroying the glaze, which they nibble, spoiling the surface of the better classes of glazed papers; they are also fond of starch and eat the starch used in binding books or papers where they can reach it. Against these insects, the following general precautions are desirable:—

(1) Add a little blue stone (sulphate of copper) to all starch paste; about half an ounce to a pound of paste is sufficient. It makes the starch distasteful to silver fish and to beetles.

(2) If possible, keep books and papers in clean cases, with plenty of flake naphthalene or naphthalene balls. We use flake naphthalene liberally with all

valuable papers and drawings, and it is always put in book shelves and cupboards.

(3) Where paper cannot be stored in cases, it should be in good, tight packages, to which insects cannot get access.

(4) If possible, take down every book on a shelf at least once in three months, dust and wipe it, open it, and if there are no beetles, replace it.

(5) All books should be painted yearly with one of the solutions given below; it is best to do this before the rainy season begins. Every part that can be reached when the book is tightly closed should be painted, the back especially, as well as the inside of the covers.

| | | |
|---|---|---|
| A. | Spirits of wine (methylated spirit) ... ... | 1 quart. |
| | Carbolic acid.. ... | 1 ounce. |
| | Corrosive sublimate.. | 1 ounce. |

The mixture is very poisonous and should be applied with a long-handled brush. It is the best, as it also checks mould; but if used, the room in which the books are, must be thoroughly aired once daily in hot weather as the sublimate is volatile and poisons the air. (See also *Agricultural News*, Vols. I, p. 140; II, p. 42; VI, p. 346.)

| | | |
|---|---|---|
| B. | Kerosene, best white... | 1 pint. |
| | Naphthalene... ... | 2 ounces. |

Rub on lightly with a cloth, or brush.

| | | |
|---|---|---|
| C. | Spirits ... ... | 1 quart. |
| | Camphor ... ... | 1 ounce. |
| | Burnt alum ... ... | ½ ounce. |
| | Corrosive sublimate... | 1 ounce. |

This mixture is used in the Pusa Library. It is as poisonous as A.

---

## SOME NOTES ON CALCIUM CYANAMIDE.

(From the *Agricultural News*, Vol. VIII., No. 179, March 6, 1909.)

The method of manufacturing calcium cyanamide, a new nitrogenous manure, the nitrogen of which is derived directly from the air, was described in the *Agricultural News* of December 12 last (page 398). In this connexion it is interesting to note some experimental work lately carried out by two French investigators with this manure, and reported on in the *Annales de l'Institut Nationale Agronomique*.

Before calcium cyanamide can be utilized by plants, it is first transformed into ammonia, and then into nitrate of soda. These changes, under favourable circumstances, are fairly rapidly effected by means of soil bacteria. Nitrification is especially rapid when the manure is applied only in small quantities at once. Very large quantities of the cyanamide applied at one time, appear to paralyse the activities of the nitrifying bacteria, with the result that transformation into nitrate of soda is considerably delayed. Experiments carried out by the French investigators mentioned, showed that the retarding action was due to the influence of the cyanamide itself rather than to the caustic lime which accompanies it, and further, that although the manure should always be used with prudence, yet soils rich in organic matter can advantageously take up more of the manure than soils deficient in this constituent. The toxic effect which the manure undoubtedly exercises on the living organisms of the soil when used in large amount is reduced to a negligible quantity when employed in moderate doses.

Nitrogen does not appear to be readily lost from cyanamide on storage. When kept in sacks, and stored in a dry place, there was scarcely any loss. When the cyanamide was mixed with kainit, there was no loss even after forty-two days. With superphosphate it was otherwise, and a loss of 5 per cent. was discovered. It would therefore seem necessary to avoid making a mixture with this manure.

The paper in question contains details of a large number of manurial experiments carried out with various crops, such as wheat, oats, maize, pasture grass, vines, etc. From the results of these trials, the conclusion is drawn that calcium cyanamide is similar in effect to an equivalent amount of sulphate of ammonia. A normal quantity of the manure to apply per acre would be about 200 lb. This may be given either before, or at the time of sowing.

---

## CEYLON AGRICULTURAL SOCIETY.

### PROGRESS REPORT XLVIII.

#### MEMBERSHIP BRANCH SOCIETIES, &C.

Since the meeting of December 18 last, the following members joined the Society:—H. M. Woolley, H. A. Brett, S. C. Biddell, Geo. Schrader (as a Life Member), W. A. De la Hoyde, A. P. Karunaratne, H. B. Rambukwelle, Dr. Kobbekaduwa Tikiri Banda, and A. C. Abeyewardene. These additions bring up the total membership to 908.

A list is being prepared of members who are greatly in arrear with their

subscriptions, with a view to submitting it to the Finance Committee.

The Wellaboda Pattu (Galle) Branch held a meeting in December, when Mr. H. A. Burden, C.C.S., presided. The introduction of improved ploughs and the holding of a Show were discussed, and a Working Committee was appointed to make arrangements for the latter. It was decided to ask the Parent Society for the services of an Agricultural Instructor to supervise transplanting in paddy cultivation at the next sowing eason.

The Sub-Committee on Tobacco Experiments met twice in January, once at Peradeniya on the 13th, and again in Colombo on the 26th. Mr. Cowan, the Superintendent of the Experiment, has been visiting Maha Illuppalama and starting nurseries.

The Assistant Government Agent of Kalutara has decided to hold three Market Shows in his district during May next—at Kalutara, Bandaragama, and Bellana. Shows will also be held at Nuwara Eliya in March, Teldeniya and Ambalangoda in June, and Harispattu in September.

### OFFICIAL TOURS.

The Acting Organizing Vice-President visited the Hambantota District and inspected the paddy lands at Tissamaharama cultivated with light iron ploughs. He also visited Maha Illuppalama in connection with the tobacco experiment.

The Secretary, after his return from India, where (accompanied by Messrs. Chelliah and Wickremaratne, Agricultural Instructors) he visited the Koilpati Agricultural Station and the Sivagiri Home Farm, as well as Bangalore, carried out inspections in Pasdum korale and Henaratgoda District.

Messrs. Wickremaratne and Molegoda have been engaged in the North-Western Province demonstrating the working of light iron ploughs at the request of the Government Agent of the Province. The following centres were selected for the demonstrations :—Makandura, Kuliyapitiya, Hettipola, Wariyapola, Kurunegala, and Potuhera.

Mr. Wickremaratne was occupied earlier in the month in the Chilaw District, supervising the work at Rajakadaluwa garden, where an experiment is being conducted in the rotation of chena crops. The implements brought over from the Koilpati Agricultural Station have been worked there, and the value of a new German apparatus for destroying white ants (sent for trial by Messrs. Freudenberg & Co.) tested.

Mr. Molegoda was engaged in Asgiri Pallesiyapattu korale of Matale South, Yatawatta, and Harispattu districts, and also inspected school gardens competing for the prize offered by the Chairman of the Harispattu Branch.

Mr. Chelliah confined himself to work in the North.

Mr. Breckenridge, who was stationed in Batticaloa, has been transferred to Maha Illuppalama, where he will act as conductor under Mr. Cowan, the Superintendent of the Tobacco Experiment.

Mr. L. A. D. Silva has not yet recovered from the effects of the severe attack of malaria contracted while at Tissa, and is being given temporary work in the office. He will shortly undertake ploughing and transplanting work in paddy cultivation in the Province of Sabaragamuwa.

### AGRICULTURAL IMPLEMENTS AND APPLIANCES.

A description of the implements brought over by the Secretary from the Koilpati Agricultural Station will be found in the Memorandum on his Indian trip, reprinted in the "Tropical Agriculturist and Magazine of the Ceylon Agricultural Society" for January, and need not be repeated here. After a trial in the Chilaw District they will go to the North, where Agricultural Instructor Chelliah will demonstrate their use. Applications for the use of these should be made to the Secretary, who will also entertain orders for supplying copies of any of the implements. Two ploughs are also coming from the Sivagiri Home Farm—one known as the Sivagiri plough, manufactured by the Manager of that farm. Trials of both will be undertaken and reported on shortly. Messrs. Walker, Sons & Co. have imported a "Picollo" Rice-shelling Machine through Messrs. Ahmed Ali & Co., of Ludhiana, and are awaiting the arrival of the sifter, or separator, before undertaking a trial of the machine. The separator is essential for ensuring proper husking or hulling, for it is necessary that the grains to be hulled should be as nearly as possible all of the same size, and to this end sifting must precede hulling.

The German apparatus for destroying white ants (already referred to) consists of a telephone arrangement for localizing the white ants and then asphyxiating them by means of sulphur vapour.

In forwarding the two ploughs previously mentioned the Superintendent of the Sivagiri Farm writes :—"According to the instructions of the Agricultural Expert, one of the ploughs sent is a

Meston plough improved at Sivagiri. Mr. Lonsdale thinks the improved Meston is more rigid and steady. They both cost the same, *i.e.*, Rs. 6."

### COTTON.

The half ton of Sea Island cotton seed received from the British Cotton Growing Association was all sold, and a late application for sowing 120 acres could not have been met.

Mr. Arno Schmidt, representing the interests of the British Cotton Growing Association, was here in the middle of January, and looked into the question of resuming ginning operations in Colombo. It is probable that the ginnery in Darley Lane will soon be again working.

A correspondent reports that a crop of cotton raised in the Province of Uva, consisting of 9,000 lb. seed cotton, gave only 2,500 lb. of lint, the rest being seed and waste. The cotton has been well reported on, but is, of course, of too small a quantity to command a ready sale. The writer states that he has "any amount" of seed, for which he will be glad to get a sale.

### PLANTS, SEED, &C.

A hundredweight of seed ginger has been received from the Agricultural Department of Madras, and is available to members at 35 cents per lb. The following note on preserving the Rhizomes will be of interest to growers:—

"A pit big enough to hold the quantity to be preserved is dug in the ground very near the wall of the house, not in a perpendicular way, but slanting towards the wall. The pit should not be exposed to the sun and rain. After the pit is dug the quantity of ginger is put into it, not at one time. Put one-fourth of the quantity at first, and then sprinkle some loose mud on it. Only a very thin layer of mud should be put. Then put another one-fourth and put mud as before, and repeat the process till the whole is thus put into the pit. This is, they say, for preventing the excess of heat. Then cover the pit with planks of wood and thoroughly cover it with mud. The pit should so closely be covered as not to allow ants and other insects to enter into the pit. The pit may be dug very near the bottom of a high levelled place, but it is better to have it very near the house, in which case the roof will prevent it from being exposed to the rain and excessive heat. The seed is to be preserved very soon after harvest, which means that it should not be allowed to get dry."



A consignment of seeds has just come to hand from the Sivagiri Home Farm, consisting of one bag (50 Madras measures) of Budshabog seed paddy, one bag of *Tephrosia purpurea* seed, one bag Kuderavali (*Panicum frumentaceum*), and an interesting collection of paddy samples, with a note on the time of sowing, harvesting, yield, &c.

A permanent collection of the agricultural products of the Eastern Tropics has been gradually worked up during the last year or two, and already a very interesting lot of local specimens sent by Agricultural Instructors has been secured. With the samples now being obtained from India, the Society will soon have the necessary materials for an Agricultural Museum, of which there is now the nucleus at the Government Stock Garden. A selection of these exhibits will be a feature of future Agricultural Shows.

The Director of Agriculture, Bengal, has forwarded a fairly large collection of cereals, oil seeds, dyes, tans, spices, drugs, and fibres of that Province. A useful catalogue accompanies the collection.

### SERICULTURE.

Another communication has come to hand from a foreign firm interested in Eri silk. They write: "We duly received at the time your small shipment of Eri cocoons, but the quality was not so good as the first sample we received from you, and we were obliged to select the 200 lb. in two parts to work separately the white and brown cocoons. The brown cocoons are not worth so much as the white ones. We are spinning now two qualities separately, but we could not give you any results till now, for it takes a long time to make these trials. When we have yarn, we will have to make trials in dyeing and see what we can do with it. But we will not wait any longer, and will settle with you the 200 lb. received. We will pay for them fr. 3 per kilo, that is, kilos 90 at fr. 3=frs. 270=25·25=£10·14, which amount will be paid to you through the Colombo Branch of the Hong Kong and Shanghai Banking Corporation. We make a large difference in the value of the white and brown cocoons, and the two qualities might be kept separately. We cannot tell to-day if for the future we can pay fr. 3 per kilo for the two qualities as our trials are not finished yet, and we do not know the results we shall have with the yarn. We shall inform you as soon as possible of the definitive results."

The Indian Imperial Entomologist writes:—"A trial on a large scale is in

progress at present at Bombay. Over 1,000 lb. of cocoons have been supplied, and the mills definitely offer Re. 1 per lb. and are paying that. There has been a very considerable development during the last few months, and the cultivation is being tried in hundreds of villages. With a large market for hand-woven cloth and a large market for cocoons, the industry in India may become established, but much depends on whether the mills go on using the cocoons. With the market so near at hand it would pay Ceylon producers to sell to Bombay. I may mention that a machine has been made and patented, which cleans the cocoons, that is, which removes all the dirt from inside the cocoons. It is a practical thing, and I have assisted in its preparation and designing. It is being sold in two forms, a factory machine doing 30 to 60 cocoons per minute, with power or hand working, and a small hand machine doing ten a minute. The clean cocoons are, of course, "100 per cent. silk," and will fetch a higher price. Samples are being worked in Bombay. If you have any growers in Ceylon you should inform me, as this and similar developments in India may be important, and I would keep you informed, say, once a month."

A small pattern cleaning machine priced at Rs. 20 has been indented for. With average cocoons two boys will be able to treat about 2 lb. per day.

### ANALYSES AND REPORTS.

The following note on kekuna resin by Mr. Frederick Lewis is of interest :—"The tree (*Canarium zeylanicum*) is moderately common in the west zone up to about 1,500 feet especially in land where underlying slab rock occurs. Though of considerable size, the wood is of no value, as it rots rapidly. It is used for making tea boxes, but there is danger of the tea being tainted by the smell of the resin. The latter is used as for fumigation, and is said to be "rough on cobras," but I cannot corroborate this. It burns freely with a pleasant odour and is probably one of the ingredients of the incense burnt in temples and mosques. The seeds are very hard and contain a fine flavoured kernel, which is much relished."

The Government Agricultural Chemist has furnished the analysis given below :—

| | Per Cent. |
|---|---|
| "Woody fibre ... ... | 15·5 |
| Moisture ... ... | 14·0 |
| Ash ... ... | 4·0 |
| Acid number ... ... | 0·8 |
| Ester number ... ... | 122·0 |
| Saponification volume ... | 122·8 |
| Iodine number ... ... | 109·0 |

When exuded, light maroon colour. Completely soluble in alcohol, from which solution it dries to a clear yellow mass."

A sample of *Erythroxylon coca* leaves from Ceylon forwarded to the Imperial Institute formed the subject of the following report made by the Director of that Institution to the Ceylon Government :—

"The coca leaves, which are the subject of this report, were forwarded for examination to the Imperial Institute by the Secretary of the Ceylon Agricultural Society with letter No. 975 dated April 22. It was stated that the leaves were grown in the Kandy District.

"The sample consisted of 3¼ oz. of leaves from 1½ to 2 inches in length, and dull olive green in colour. They were very dry and brittle, but the sample was remarkably free from broken leaves.

"The leaves were examined chemically and found to contain a satisfactorily high proportion, 1·2 per cent. of total alkaloid soluble in light petroleum. The quantity of material was, however, not sufficient to permit of the identification of the alkaloids or the isolation of cocaine.

"The sample was valued by brokers at 9*d*. per lb. in London (November, 1909), but they pointed out that coca leaves are at present realizing more than the average price.

"As the leaves differed somewhat from the Bolivian and Peruvian leaves of commerce, and showed certain resemblances to Java coca leaves, they were submitted to a botanical expert, who reported that their identity was doubtful, but in his opinion they resembled Java leaves more than any other commercial variety. There thus appears a possibility that doubt may arise as to the botanical origin of some consignments of coca leaves from Ceylon. The principal difference between the South American and Java leaves is that while the former contain cocaine as the principal alkaloidal constituent, the Java leaves contain little or no cocaine, but only certain related alkaloids, which after extraction are readily convertible into cocaine. The South American leaves can therefore be used for the manufacture of medicinal prepartions of coca, whereas the Java leaves are only suitable for the manufacture of cocaine.

"In these circumstances, the Secretary of the Ceylon Agricultural Society was asked to state the origin of the present sample of leaves, and he replied that they were derived from plants of Bolivian coca introduced into the Kandy

District in 1893. It would therefore be desirable to ascertain definitely the proportion of cocaine present in these Ceylon coca leaves, and the nature of the other alkaloids they contain. For the purpose of this investigation about 14 lb. of leaves should be forwarded to the Imperial Institute." The quantity required has been forwarded.

Mr. E. T. Hoole, Assistant Government Veterinary Surgeon, has kindly reported on a Tamil veterinary publication entitled "Handbook of Hindu Medicines for Horses and Cattle," forwarded to the Society by the author. He says: "I find that it affords useful information, and will be of special service to those who are out of reach of immediate veterinary aid. The drugs recommended are mostly those that could be easily obtained from the bazzar or field."

The following is a report made on samples of Batticaloa soils, which were furnished at the request of the Government Agricultural Chemist:—

"I have the honour to report on the samples of soil from Batticaloa District, received together with your letter No. 2,727.

"*Box No. 1 from Sengalladi Estate and Box No. 2 from Kiran Estate* are coarse quartzy soils, and consist of almost pure quartz sand. No. 2 is in a coarser state of division than No. 1. The distribution of plant food is typical of such soils, but the lime and magnesia are higher than in similar soils of the Chilaw and Kalutara Districts. The potash and phosphoric acid are present in very poor quantity, but not less than is usually found in coconut soils. The acidity is only faint in Kiran, but in the other soils it is acid. A dressing of burnt lime or basic slag or both would prove beneficial to such soils.

"*Box No. 3, Vandarumulla Estate*, is similar in composition to the previous soils, but has not such a good supply of potash and phosphoric acid, and crops would be improved by the addition of these. The lime is less in this soil than the two previous ones.

"*Box No. 4, Sunkunkerni Estate*, is similar in general composition and character to the other soils, but is noted for the deficiency of potash and phosphoric acid, and if these were replenished and accompanied by a liberal application of cattle manure, the trees would no doubt in time respond to the treatment with increased crops.

"*Box No. 5, Karavakoo fields*, where pinmari or kalvellamai is cultivated, is clay mixed with quartzy sand. The state of division is even so that the coarse sand tends to keep it open. This soil is of an entirely different character to the others tested, having larger supplies of mineral plant food than are usually found in Ceylon soils. The magnesia is very high, and there are good supplies of lime and potash, and the phosphoric acid, although in less proportion, is still to be considered a high percentage. The humus matter and nitrogen are present in fair quantity. This soil would give a good many more crops than one per annum.

"*Box No. 6, Akkaraipattu fields*, where munmari or cultivation by rain is carried on, is also of the same class of soil as Sunkunkerni, and is similar in composition to the others.

"In all the first lot of soils large quantities of freshly burnt ashes, which are rich in potash, unexposed to the atmospheres, should be applied along with finely ground bones, which are rich in phosphoric acid, and large supplies of cattle manure, which will supply the humus and the nitrogen. All these soils require replenishing in these constituents, and would no doubt improve the crop."

(The actual figures of analyses are not reproduced.)

MISCELLANEOUS.

The fancy curtain, referred to in last Progress Report, has been presented to the Society by Mr. James Perera of Molligoda, who is anxious to work up a local industry in the manufacture of such articles as curtains, boxes, &c., from the kekilla (*Gleichenia*) fern, which is so common everywhere, and is at present put to no use. The article could be inspected in the Society's office. The following is a description of how it is made:—"Hard kekilla reeds with the pith extracted are exposed for three or four days to the wind and then cut into the required lengths. The pieces are strung together and then enamelled and left to dry. When they are sufficiently dry the thread is removed and the pieces are re-strung as per sample curtain. After the curtain is made, any required design can be painted on it. Before painting the strings should be drawn down to a uniform tightness and fastened. Another way of producing a design would be by painting pieces of reed differently and stringing them so as to bring out the required pattern."

ERRATUM.

Mr. J. F. Jowitt writes:—"I apologize for asking a further correction. *Pennisetum cenchroides*, Rich., takes precedence of *Conchrus mutabilis*, Wight ex

Hook, as the botanical name of Congayam grass, and so appears in 'Flora, British India.' I misread Mr. Lock's note to me on the subject, and was only able to correct my error too late for insertion in the January '*Tropical Agriculturist.*' I am greatly handicapped by having no books of reference of my own."

C. DRIEBERG,
*Secretary.*

Colombo, February 7, 1910.

---

## WEEDS.

[Paper read before the Board of Agriculture by R. H. Lock, Acting Director, Royal Botanic Gardens, on Febuary 7th, 1910.]

A weed is generally defined as a plant out of place. Most frequently weeds are also useless plants, but useful and even cultivated plants may also become pests when they persist in making their appearance in places where they are not wanted,

The objections to weeds amongst cultivated crops are so obvious that it is scarcely necessary to allude to them. The greater number of these objections may be summed up in the single word "competition." The weeds compete with the cultivated plants for space, air, and light, as well as for the water and soluble constituents of the soil. The removal of this competition is one of the primary and most fundamental operations of agriculture. The loss of crops caused by allowing weeds to grow freely may easily amount to 50 per cent, or more, and the presence of weeds in the soil enormously increases the labour which has to be expended in tillage and cleaning operations.

Other more or less minor disadvantages are peculiar to special kinds of weeds. Climbing weeds may overrun a crop and bear it to the ground, or they may choke the individual plants by the tightness of their coils. The seeds of certain weeds may contaminate the crop of grain or other valuable seed, and cause a marked deterioration in its market price. Other weeds are poisonous to stock, whilst others, again, may habour insect pests and parasitic fungi, which sooner or later find their way to the cultivated crops.

Many of the worst weeds of any given district will be found to have been introduced into it from some other district or country. Thus, many of the corn-field weeds of England have been introduced at different times from Eastern Europe. In spite of the many excellent means of distribution which Nature provides for the dissemination of seeds and other reproductive parts of plants, it is usually found that the majority of the least desirable weeds of any country have been introduced through human agency, either accidentally mixed with the seeds of useful economic plants or other commercial produce, or in many cases deliberately, owing to some beauty of the plant having been recognized, but not its harmful tendency to spread where it was not wanted.

Natural means of dispersal suffice, however, to transport the seeds of innumerable weeds over considerable distances. Whenever forest land is cleared the weeds of the surrounding country soon begin to appear upon it, and, if unchecked, may take complete possession of the cleared soil until it becomes impossible to grow any crop without an enormous expenditure on weeding. The principal non-human agencies for the dispersal of seeds are two: the wind and wandering animals. A great number of beautiful contrivances are to be found in Nature adapting seeds to travel by one or other of these means of conveyance, and for a description of these I must refer my hearers to the work of Darwin and other writers. The practical conclusion is that no more land should be cleared at one time than can be taken into immediate cultivation. The cost of weeding begun as soon as the "burn-off" is completed is an insignificant item compared with the cost of eradicating weeds when they are once firmly established. For the seeds which come from a distance are few and scattered, and of many which set out upon their journey few travel over long distances. The majority of even the strongest winged seeds fall to the ground close to their starting point. Cleared jungle land is practically free of the seeds of weeds, and the comparatively few casual arrivals can easily be destroyed before their own seeds ripen. But once the first colonists are permitted to set seeds themselves, their progeny springs up in constantly increasing numbers until the whole available space is occupied.

The first principle in destroying weeds is therefore to attack them before they have had time to ripen seed. If the seeds which fall at a given time all germinated at once, it would be easy to exterminate any weed which is solely seed-propagated in a comparatively short space of time. Unfortunately the seeds do not all germinate at once; many lie dormant for varying periods, so that

germination takes place at irregular intervals, producing a succession of weeds, which must be repeatedly destroyed before the time of flowering, if the weeding is to be permanently successful. The process of examination can be accelerated to a certain extent by tillage, which leads to the immediate germination of a large proportion of seeds, and must be followed as before by repeated weeding.

Weeds which have other methods of reproduction besides that of seeding are even more difficult to deal with. Many weeds of the worst class are perennial. The well-known Lalang, or illuk grass (*Imperata arundinacea*), for example, has strong underground root stocks, which extend far and wide in the soil. Small pieces broken from the creeping rhizomes by ploughs or other implements are often spread abroad in the land, and may grow into individuals as strong as the original plants from which they were derived. The attempt to dig out the illuk, unless carried out with the most extreme thoroughness, may therefore merely lead to an increase of the nuisance.

Continual mowing down and removal of the green parts of a plant of this kind will tend to weaken it materially, although illuk itself is very resistant to such treatment. Nevertheless, repeated pulling up of the shoots as fast as they appear must necessarily result in the exhaustion of the stored food, and effectually prevents the manufacture of more, since it is in the leaves that the production of food takes place.

Land infected with illuk, which is not required for immediate cropping, can most easily be dealt with by growing some other plant which is able successfully to compete with it. Such a plant is the common climbing weed *Micania scandens*, which, however, ceases to be a weed in this connection whilst it is being employed for a useful purpose. Several other climbing plants can be used in a similar manner, their only necessary qualification being that they should themselves be easy to exterminate when the battle with the illuk has ended in their favour. In some cases at least these creeping plants are able to destroy the illuk grass by climbing over it and weighing it down to the ground with a mass of heavy green foilage, which cuts off the illuk from air and light and leads to the final extermination of the more virulent weed. The creepers themselves are afterwards comparatively readily amenable to the ordinary operations of weeding.

Another weed which is found particularly difficult to exterminate is the Oxalis, which infests some up-country tea estates. Apparently this weed does not at present affect the yields of the tea bushes very greatly, but there can be no doubt that it removes, temporarily at least, a large proportion of the manure intended for the tea. The Oxalis is propagated by vast numbers of minute bulbils, which, on account of their earthy colour and minute size, are quite impossible to extract completely by the most careful hand weeding. The policy of smothering by a vigorous creeping plant is not applicable on a tea estate, as the tea would be smothered as well as the weeds, and would probably fare worse than the Oxalis, which is itself a shade-loving plant. The only method I have heard of which is found to be at all effective is to dig out the plant, root and all, with the earth intact, and burn plant and earth together. But this is a method which can obviously only be applied when the weed is confined to a small area.

I do not know whether the experiment has been made of attempting to choke out the Oxalis by growing some such plant as Crotalaria amongst the tea. Since the mulch of Crotalaria leaves and stems obtained in this way by cutting before the time of flowering is known to be of the utmost benefit to the tea, there could be no harm in making the attempt, although it is impossible to say whether the Oxalis would be exterminated or only benefited like the tea by the additional supply of nitrogen.

In setting one weed to kill another in this way considerable discretion is required in order that the remedy may not turn out to be worse than the disease. Thus, the suggestion was made some time ago to introduce *Tithonia diversifolia*—the common yellow sunflower of our roadsides and railway embankments—into some parts of Southern India. The suggestion was made by a forest officer, who had heard from a high authority that this plant was a most effective agent for exterminating lantana. Now, this happens to be perfectly true; but I have never heard of any agent which will in its turn effectively exterminate the sunflower when it is once established. And I would here point out that the climber *Micania scandens*, alluded to a little time ago, is itself a troublesome weed in many instances, and should never be introduced except for the express purpose of destroying a worse weed such as illuk.

Indeed, there is no royal road to the eradication of weeds. We are

constantly being asked to recommend some less laborious process than hand weeding, which will prove equally effective, but it is very seldom that such a recommendation can be made. The method of spraying with some poison, such as sodium arsenite, seems to be effective with some kinds of weed, but it leaves others almost untouched, and it must be repeated over and over again as more seeds germinate or as fresh shoots arise from the buried portions of the plants. The great objection to all such methods is that the poison from the spray is very liable to fall alike upon the cultivated plant and upon the weed, and the successful manipulation implies an amount of skill, which, combined with the original cost of the necessary apparatus, makes it very doubtful whether the method can compete successfully with the ordinary mechanical operations.

On level ground a great deal can be done with the ordinary machinery of cultivation—ploughs and harrows of various kinds—and this fact is at last beginning to be recognized in several parts of Ceylon. We have found on the Government Experiment Stations that by the use of modern machinery an amount of labour can be saved, which very soon pays for the first cost of the necessary apparatus. A good plough which turns the soil completely over so as to bury the weeds at a depth of a few inches causes the immediate destruction of innumerable plants. A large proportion of the weeds so buried are completely stifled and are unable to make their way again to the surface.

On soil which has been already loosened by ploughing we find the disc harrow an invaluable implement, although its use is more limited than that of the plough, inasmuch as it can only be used when the soil is comparatively dry. The disc harrow, therefore, cannot be used in moist paddy fields, whereas the plough works best in comparatively moist soil. This implement churns up the whole surface of the ground to a depth of two or three inches, and as it works very rapidly, covering three or four acres in a day, it can be sent over the ground again and again, destroying each crop of weeds as fast as it arises. We have also other implements adapted for working between the rows of standing cotton and other crops, and although some of these may appear complicated at first sight, there can be no doubt that they have a very marked effect in the direction of saving labour weeding.

After all, prevention is better than cure. Let me quote the words of Dr. A. J. Ewart, writing upon the subject of the weeds of Victoria :—"It is not too much to say that no new plant should be introduced to this State, and not even in a private garden, if there is any chance of its spreading, unless an official report upon its capacities for good and evil has been obtained, and unless the report is a favourable one. Although the annual loss due to weeds is difficult to estimate, owing to its generalized and diffuse character, there can be no doubt that if suitable regulations had been in force fifty years ago, the country would now be saved an annual loss of several hundred thousand pounds." Australia is well known to be a country particularly susceptible to the rapid spread of introduced weeds, and legislation now exists directed against more than 100 varieties of these pests, as compared with a single "proclaimed plant" in Ceylon—the water hyacinth. Nevertheless, our own list of undesirable aliens is not a short one, and a comparatively small amount of misdirected energy would suffice to lengthen it materially. I need only mention as examples :—

*Lantana aculeata*, introduced as an ornamental plant soon after 1824; the *Tithonia diversifolia*, or wild sunflower, which was only introduced as a garden plant as recently as 1851, and probably, I am afraid, spread from Peradeniya; *Mimosa pudica*, the sensitive plant, also introduced from America; and the Oxalis already alluded to, which is originally a native of the United States. Happily the inhabitants of Ceylon are becoming cautious of casual acquaintances from the outside world of plants, and I have not heard of the recent introduction of any serious pest in spite of our freedom from special legislation.

There has recently been some discussion in the local press as regards the *uses* of weeds. As I have already pointed out, it would simplify matters a good deal if the term "weed" were confined to plants when and where they are useless, or at least where the disadvantages of their presence outweigh the advantages; and if the rule were made to apply some other term to plants which are grown or allowed to grow for a specific purpose.

Plants which are weeds under certain circumstances, may under other circumstances have the following recognised uses :—

1. The use as nitrogenous plants grown for the purpose of enriching the soil in this most important element.

2. As cover plants grown to shade the soil and to enrich it with added humus, but not necessarily with nitrogen.
3. Plants grown on steep slopes in order to check wash.
4. Shade plants and wind breaks.
5. Sand binding plants, which prevent the spread of shifting sands.
6. Climbing plants grown for the purpose of smothering particular weeds.

Any one of these six headings might easily form the topic of a separate paper much longer than the one which I have now had the honour of reading to you. But I wish it to be clearly understood that in speaking of weeds I have intended to exclude all plants which are used for any of these perfectly legitimate purposes.

---

## PLANT BREEDING.

(From the *Hawaiian Forester and Agriculturist*, Vol. VI., No. 7, July, 1909.)

It is not improbable that the department of agricultural science which will most benefit the human race in future years is that of plant breeding. Hitherto but little has been achieved by the scientific plant breeder, that is, little in comparison with the boundless store of varieties of plants suited to fulfil peculiar economic conditions which, it is predicted, will be evolved by the operations of principles which are now becoming to be understood and successfully applied. It is true that our cultivated varieties of fruits, flowers and grains have been produced from elementary ancestors of little resemblance to their luxuriant descendants, but the process of evolution has been achieved only after great duration of time and often under methods whose true scientific principles were little understood. At first primitive man gathered from their native habitat the few uninviting roots and seeds with which he appeased his hunger. The first step towards improvement of such food plants took place when in order to save the labour of gathering, he planted them near his home and aided their development by working the soil and discovered the beneficial use of fertilizer. Then commenced a long and slow period of advancement. By selection of the more promising plants as parents for the new crop, the hard woody qualities of the primitive ancestors of our vegetables developed into the soft and succulent varieties of our garden crops. The hard and acrid berries of the vine and tree mellowed into the generous and luscious grape, apple and peach.

All this, however, necessitated many centuries of laborious work, and many of the advances taken were no doubt unconscious. At length in China and ancient Rome the breeding of plants came to be looked upon as a regular profession, and to these countries and to the members of the monastic houses of the middle ages are to be attributed many of the most direct advances in plant production. It is only now, however, that the principles lying at the basis of the improvement of plant stocks are beginning to be applied, and that scientific agriculturists are consciously breeding plants for specific purposes. Given time, and that a not too distant date, the modern plant breeder will produce types of plants to resist particular fungus and insect pests; he will evolve varieties of economic plants to flourish in climatic conditions now considered impossible for their existence; he will multiply their production three-fold; and finally by combination he will produce new breeds of plants of entirely new type.

It is to be considered that hitherto the development of our present economic plants has been confined almost exclusively to the flora of temperate zones. When the principles of scientific breeding have applied for some generations to our luxuriant tropical species, the great future for this new department of science can be partly appreciated. For this purpose Honolulu is particularly well situated and is fortunate in the presence here of scientists who are not only versed in the new methods of development, but has already made headway in their operation. Among the work already in progress may be mentioned the production of a new rice and a new cotton specially adapted to our peculiar needs, and the development of a variety of the papaia possessing sufficiently toughened skin to withstand the long transit to the mainland market.

---

# Correspondence.

## PASPALUM DILATATUM IN THE NORTH.

Nallur House,
Jaffna, 22nd January, 1910.

DEAR SIR,—I am growing the grass called *Paspalum dilatatum* on a piece of land 2 lachams ($\frac{1}{8}$ of an acre) in extent adjoining my house. It is in a fair condition, though the watering was not regular. But this grass does not grow as high as the Guinea grass.

In my opinion it will grow well if sufficient attention is paid to regular watering in dry places like Jaffna. The leaves or rather the blades are not so rough as those of the Guinea grass.

Yours faithfully,
M. ASAIPILLAI.

# MARKET RATES FOR TROPICAL PRODUCTS.

*(From Lewis & Peat's Monthly Prices Current, London, 19th January, 1910.)*

| | QUALITY. | QUOTATIONS. |
|---|---|---|
| ALOES, Socotrine cwt. | Fair to fine ... | 85s a 90s |
| Zanzibar & Hepatic ,, | Common to good .. | 40s a 70s |
| ARROWROOT (Natal) lb. | Fair to fine .. | 6d a 7d |
| BEES' WAX, cwt. | | |
| Zanzibar Yellow ,, | Slightly drossy to fair ... | £6 12s 6d a £6 15s |
| Bombay bleached ,, | Fair to good | £7 10s a £7 12s 6d |
| ,, unbleached ,, | Dark to good genuine .. | £5 10s a £6 7s 6d |
| Madagascar ,, | Dark to good palish | £6 10s a £6 15s |
| CAMPHOR, Japan ,, | Refined | 1s 6¼d a 1s 7½d |
| China ,, | Fair average quality ... | 136s |
| CARDAMOMS, Tuticorin | Good to fine bold | 2s a 2s 5d |
| | Middling lean | 1s 9d a 1s 10d |
| Tellicherry | Good to fine bold .. | 2s a 2s 3d |
| | Brownish .. | 1s 6d a 1s 9d |
| Mangalore ,, | Med brown to fair bold | 1s 10d a 2s 8d |
| Ceylon.- Mysore ,, | Small fair to fine plump | 1s 4d a 2s 11d |
| Malabar .. | Fair to good .. | 1s 4d a 1s 6d |
| Seeds, E. I. & Ceylon ,, | Fair to good .. | 1s 7d a 1s 8d |
| Ceylon Long Wild ,, | Shelly to good .. | 6d a 1s 9d |
| CASTOR OIL, Calcutta ,, | Good 2nds .. | 3⅛d a 3¼d |
| CHILLIES, Zanzibar cwt. | Dull to fine bright ... | 35s a 40s |
| CINCHONA BARK.- lb. | | |
| Ceylon | Crown, Renewed | 3⅜d a 7d |
| | Org. Stem | 2d a 6d |
| | Red Org. Stem | 1¾d a 4¼d |
| | Renewed | 3d a 5¼d |
| | Root | 1⅞d a 4d |
| CINNAMON, Ceylon 1sts | Good to fine quill | 10d a 1s 4d |
| per lb. 2nds | ,, ,, | 9d a 1s 2d |
| 3rds | ,, ,, | 7½d a 11½d |
| 4ths | ,, ,, | 6½d a 9½d |
| Chips, &c.. | Fair to fine bold | 2⅜d a 3¼d |
| CLOVES, Penang lb. | Dull to fine bright pkd. | 1d 5s a 1s 6d |
| Amboyna .. | Dull to fine | 8¼d a 9d |
| Ceylon .. | ,, ,, | 8½d a 9d |
| Zanzibar | Fair and fine bright | 4⅝d a 5d |
| Stems .. | Fair | 1¾d |
| COFFEE | | |
| Ceylon Plantation cwt. | Medium to Bold | 65d a 100s |
| Native | Good ordinary | nominal |
| Liberian ,, | Fair to bold | 43s a 55s |
| COCOA, Ceylon Plant. ,, | Special Marks | 60s a 70s |
| | Red to good | 53s a 59s |
| Native Estate ,, | Ordinary to red | 37s 6s a 52s 6d |
| Java and Celebes ,, | Small to good red | 30s a 85s |
| COLOMBO ROOT ,, | Middling to good | 15s a 17s 6d |
| CROTON SEEDS, sift. cwt. | Dull to fair | 47s 6d a 50s |
| CUBEBS ,, ,, | Ord. stalky to good | 80s a 90s |
| GINGER, Bengal, rough ,, | Fair | 35s nom. |
| Calicut, Cut A ,, | Small to fine bold | 60s a 85s |
| B & C ,, | Small and medium | 52s a 60s |
| Cochin Rough ,, | Common to fine bold | 42s a 44s |
| | Small and D's | 40s |
| Japan ,, | Unsplit | 39s |
| GUM AMMONIACUM ,, | Sm. blocky to fair clean | 25s a 60s |
| ANIMI, Zanzibar | Pale and amber, str. srts. | £16 a £18 5s |
| | ,, ,, little red | £13 a £15 |
| | Bean and Pea size ditto | 75s a £14 2s 6d |
| | Fair to good red sorts | £9 a £13 10s |
| | Med. & bold glassy sorts | £6 5s a £8 10s |
| Madagascar ,, | Fair to good palish ... | £4 a £8 15s |
| | ,, ,, red ... | £4 a £7 10s |
| ARABIC E. I. & Aden ,, | Ordinary to good pale | 25s a 32s 6d nom. |
| Turkey sorts ,, | | 3 s a 47s 6d |
| Ghatti ,, | Sorts to fine pale ... | 20s a 42s 6d nom |
| Kurrachee ,, | Reddish to good pale ... | 20s a 30s ,, |
| Madras ,, | Dark to fine pale ... | 15s a 25s ,, |
| ASSAFŒTIDA ,, | Clean fr to gd. almonds | £9 10s a £10 5s |
| | com. stony to good block | 15s a £8 |
| KINO | Fair to fine bright | 6d a 9d |
| MYRRH, Aden sorts cwt | Middling to good | 60s a 70s |
| Somali ,, | ,, ,, | 55s a 60s |
| OLIBANUM, drop ,, | Good to fine white | 40s a 50s |
| | Middling to fair | 25s a 35s |
| pickings ,, | Low to good pale | 6s 6d a 17s 6d |
| siftings ,, | Slightly foul to fine | 13s a 15s |
| INDIA RUBBER lb. | Fine Para bis. & sheets | 7s 10½d |
| | ,, Ceara ,, ,, | 7s 6d |
| Ceylon, Straits, | Crepe ordinary to fine.. | 7s 10d a 7s 11½d |
| Malay Straits, etc. | Fine Block .. | 8s 7d |
| | Scrap fair to fine .. | 6s 6d a 6s 9d |
| Assam | Plantation .. | 4s 6d a 5s |
| | Fair II to ord. red No. 1 | 4s a 4s 6d |
| Rangoon | ,, ,, | 3s a 3s 6d |

| | QUALITY. | QUOTATIONS |
|---|---|---|
| INDIARUBBER.(*Contd.*) | | |
| Borneo | Common to good | 1s 8d a 2s 10d |
| Java | Good to fine red .. | 2s 6d a 3s 9d |
| Penang | Low white to prime red | 2s a 2s 9d |
| Mozambique | Fair to fine red ball ... | 4s 9d a 5s 3d |
| | Sausage, fair to good .. | 4s 4d a 4s 10d |
| Nyassaland | Fair to fine ball ... | 3s 8d a 4s 4d |
| Madagascar | Fr to fine pinky & white | 3s 2d a 3s 9d |
| | Majunga & blk coated .. | 2s 6d a 2s 10d |
| | Niggers, low to good .. | 1s 6d a 2s 6d |
| New Guinea | Ordinary to fine ball .. | 3s 2d a 4s 2d nom |
| INDIGO, E.I. Bengal | Shipping mid to gd violet | 2s 10d a 3s 8d |
| | Consuming mid. to gd. | 2s 6d a 2s 10d |
| | Ordinary to middling | 2s 2d a 2s 5d |
| | Oudes Middling to fine | 2s 6d a 2/8 nom. |
| | Mid. to good Kurpah | 2s 2d a 2s 6d |
| | Low to ordinary | 1s 6d a 2s |
| | Mid. to fine Madras | 1s 5d a 2s 4d |
| MACE, Bombay & Penang | Pale reddish to fine | 1s 11d a 2s 4d |
| per lb. | Ordinary to fair | 1s 8d a 1s 10d |
| Java | ,, ,, good pale | 1s 7d a 2s |
| Bombay | Wild | 4d a 5d |
| MYRABOLANES, cwt | UG and Coconada | 5s a 5s 6d |
| Bombay ,, | Jubblepore | 4s 9d a 5s 10½d |
| | Bhimlies | 4s 9d a 6s 3d |
| | Rhajpore, &c. | 4s 6d a 5s 3d |
| Bengal ,, | Calcutta | 5s a 5s 6d |
| NUTMEGS— lb. | 64's to 57's | 1s 3d a 1s 6d |
| Bombay & Penang ,, | 110's to 65's | 4¾d a 1s 2d |
| | 160's to 115's | 4d a 4½d |
| NUTS, ARECA cwt. | Ordinary to fair fresh | 15s a 17s 6d |
| NUX VOMICA, Cochin | Ordinary to good | 9s a 11s 6d |
| per cwt. Bengal | ,, ,, | 6s a 6s 6d |
| Madras | ,, ,, | 6s 3d a 8s |
| OIL OF ANISEED ,, | Fair merchantable | 4s 6d |
| CASSIA ,, | According to analysis | 3s 6d a 3s 10d |
| LEMONGRASS ,, | Good flavour & colour | 2d a 2¼d |
| NUTMEG ,, | Dingy to white | 1⅛d a 1⅜d |
| CINNAMON ,, | Ordinary to fair sweet | 2¼d a 1s |
| CITRONELLE ,, | Bright & good flavour | 1s |
| ORCHELLA WEED—cwt | | |
| Ceylon ,, | Mid. to fine not woody... | 8s a 10s |
| Madagascar ,, | Fair ... | 8s |
| PEPPER– (Black) lb. | | |
| Alleppee & Tellicherry | Fair .. | 3⅞d |
| Ceylon | ,, to fine bold heavy .. | 3¾d a 4⅛d |
| Singapore ... | ,, ... ... ... | 4⅛d |
| Acheen & W. C. Penang | Dull to fine .. ... | 3½d a 3¾d |
| (White) Singapore ,, | Fair to fine .. .. | 7d a 8d |
| Siam ,, | Fair .. ... .. | 7d |
| Penang ,, | Fair .. ... .. | 6¼d |
| PLUMBAGO, lump cwt. | Fair to fine bright bold | — |
| | Middling to good small | — |
| chips | Dull to fine bright .. | — |
| dust | Ordinary to fine bright | — |
| SAGO, Pearl, large ... | Dull to fine .. . | 16s 6d a 18s |
| medium . | ,, ,, | 15s a 16s |
| small ... | ,, ,, | 14s a 15s |
| SEEDLAC cwt. | Ordinary to gd. soluble | 50s a 65s |
| SENNA, Tinnevelly lb. | Good to fine bold green | 4½d a 7d |
| | Fair greenish | 3¾d a 4½d |
| | Common speckyand small | 1½d a 2¾d |
| SHELLS, M. o'PEARL— | | |
| Egyptian cwt. | Small to bold .. | 28s a 127/6 nom. |
| Bombay ,, | ,, .. | 18s a 127s 6d |
| Mergui ,, | ,, ,, ... .. | £8 10s a £9 5s |
| Manilla ,, | Fair to good .. | £6 10s a £10 15s |
| Banda ,, | Sorts .. ... | 25s a 30s nom. |
| TAMARINDS, Calcutta... | Mid. to fine bl'k not stony | 11s a 12s |
| per cwt. Madras | Stony and inferior .. | 4s a 5s |
| TORTOISESHELL— | | |
| Zanzibar, & Bombay lb. | Small to bold .. | 11s 6d a 31s |
| | Pickings .. | 7s a 17s |
| TURMERIC, Bengal cwt. | Fair . | 17s 6s |
| Madras ,, | Finger fair to fine bold | 17s a 18s |
| Do. ,, | Bulbs [bright | 14s a 15s |
| Cochin ,, | Finger .. | 15s |
| | Bulbs .. | 13s 6d |
| VANILLOES— lb. | | |
| Mauritius .. } 1sts | Gd crystallized 3½ a 8½ in | 12s a 18s |
| Madagascar ... } 2nds | Foxy & reddish 3½ a ,, | 11s a 18s |
| Seychelles .. } 3rds | Lean and inferior ... | 11s a 11s 6d |
| VERMILLION ,, | Fine, pure, bright .. | 3s 3d |
| WAX, Japan, squares | Good white hard ... | 44s |

THE SUPPLEMENT TO THE

# Tropical Agriculturist and Magazine of the C. A. S.

COMPILED BY A. M. & J. FERGUSON.

No. 2,] FEBRUARY, 1910. [VOL. VI.

## MOISTURE IN COPRA.

I.

Moisture gives rise to deterioration in many commodities produced in India, and we have repeatedly drawn attention to the importance of improved methods of drying. The deterioration results from the fact that various chemical and bacterial changes take place in the presence of moisture. These induce either direct consumption or conversion of valuable constituents, or injury through the development of heat, or such defects as an undesirable colour, smell or taste. It may probably be said that the commonest agents in such accidents are moulds and bacteria, though it was seen from Mr Lefroy's interesting paper (published in our*) issue of the 18th November that the destruction of wheat by weevil is dependent on moisture and may be controlled by its elimination. One of the commodities most sensitive to action by micro-organisms is copra. This is due to the presence in it of constituents on which moulds and bacteria feed; but moisture must also be present in a certain measure before these forms of life can germinate. When these conditions exist and organisms appear, the copra deteriorates both through the destruction of the oil proteids and carbo-hydrates and through the establishment of bad colour, taste and smell. The copra industry is one associated in India mainly with the coast line and the banks of great waterways. In these regions the air is commonly moist, so that drying is relatively slow. During the rainy season drying is impracticable in the open and the trade is entirely arrested. At other seasons when storms, showers or heavy dews are experienced, it is retarded and the product is apt to be deficient both in quality and in content of oil, sugars and albumen.

The *Philippine Journal of Science* for February 15th, 1906, contained a useful paper on the *Keeping Qualities and the Causes of Rancidity in Coconut Oil.* The experiments described included a number with copra; and the author said:—

"The most important fact brought out by this work is that by far the greatest deterioration which an oil undergoes takes place in the copra itself. After an oil has been expressed from the dried meat, its change on standing is very slight compared with that which is found in the same time while it is in copra. No great amount of rancidity was developed in any case until signs of mould or bacterial growth were visible on the surface of the copra. From this it would seem very probable that the splitting up of fat and the accompanying rancidity produced in copra are in a large measure due to the action of micro-organisms which have an excellent culture medium in the sugar, albuminoids and water which exist together with the oil in coconut meat."

The author proceeds to quote other authorities who have shown that cotton-seed meal containing a sufficient amount of water is attacked by moulds and bacteria and that the oil therein is, on long standing, almost completely destroyed. He then details the sets of experiments made with copra (*a*) when inoculated with a solution from an old mouldy sample and (*b*) when left exposed to attack by such micro-organisms as might be present in the atmosphere. It was seen that the two sets of specimens behaved very much alike. The period of experiment was only fourteen days and the actual loss of oil was, therefore, in no case great but, as the author says, "it was sufficiently marked to show that it also chiefly took place in those tubes which contained a growth of mould; the loss of substances other than oil, on the contrary, was considerably less where the mould was most vigorous." ...... "The large loss in substances other than oil (sugars, albuminoids, etc.,) was confined to those tubes in which bacteria predominated—that is, those containing more than 16·67 per cent of moisture—indicating that bacteria obtain their carbon and hydrogen chiefly from the sugars, albuminoids and cellulose which are present in copra, while moulds directly attack the oil."

"The most important point to be considered from a practical point of view is," according to the author, "that copra containing as little as 9 per cent of moisture is still attacked by moulds

* *Indian Trade Journal.*—A. M. & J. F.

with the consequent production of free acid and colouring matter as well as loss in weight of oil. Unfortunately the copra produced in the Philippine Islands ordinarily contains from 9 to 12 per cent of water, a condition which is the most favourable for mould growth and for the deterioration of the oil. The remedy for this is obvious. A more complete drying to reduce the water content to 5 per cent or less will produce a copra which is unattacked by organisms. Such a product, kept dry, will remain fresh and sweet for a long time. In a previous part of this paper I have shown that copra, once sufficiently dried, may be kept during the dry season in Manila without any change whatsoever ; but recent experiments prove this not to be the case during the rainy one, even with anhydrous copra." These experiments, as described by the author, showed that copra entirely free of water could in one month of the rainy season acquire sufficient moisture to develop moulds after the containing vessel had been closed, while another sample which remained exposed to the atmosphere for two months changed less. As regards India it does not appear that any complete analysis has been made for the purpose of determining the percentage of moisture in purely Indian copra, but it is believed to be about 6 per cent. But to return to the Philippines. We quote also the conclusion on this point arrived at by the same investigator after further experiments which were recorded in the same *Journal* for 1908 :—

"The results given above, when applied to the question of the diminution in value of commercial copra, would render it certain that such copra, *if mouldy*, has suffered a loss in total oil, of course not in all probability as great as I noticed in some cases (19·9 per cent), for my copras were placed under the most favourable conditions for the maximum of mould action; but, nevertheless, this change must amount to a sufficient quantity to be considered in the purchase of copra which has suffered from the action of moulds.

"Such material undoubtedly cannot give as good a yield of oil as others which have been carefully dried and preserved. However, another factor must also be considered. Poorly dried and preserved copras, if a sufficient quantity of water (above 15 per cent) is present, suffer from *bacterial* and not from *mould* actiou ; in which event no diminution of oil would be observed, but, nevertheless, bacteria so disintegrate and change the copra that a slimy, soft mass, difficult to work so as to procure pure oil reasonably free from acid, results. A bad odour also frequently accompanies such copras."

It is thus evident that thorough drying is of crucial importance in the production of copra. The author of the paper from which we have quoted conducted a series of experiments in several methods of drying, and we propose to review his results in our next issue. —*Indian Trade Journal*, Dec. 23.

II.

Since the quick and through drying of copra has been shown in the last issue of the *Indian Trade Journal* to be of such vital importance in order to insure the production of a pure oil, the results of an investigation made in the Philippines of various methods of copra drying may prove of interest. The simplest mode of drying copra is to expose the nuts, cut in halves, to the action of the sun during about five days. This method, although slow, produces a very fair quality of copra. However, a sudden rainstorm or a succession of cloudy days is sufficient to start mould and bacterial growth, with the consequent deterioration of the copra. Considerable loss, due to the attacks of insects and animals, is also suffered during the long period of drying, and the finished product very seldom contains less than 9 per cent of moisture.

A much quicker method is the one carried out by laying the half uuts, face downward, on a bamboo grating placed over a slow fire of coconut husks. After being dried in this manner over night, the nuts are removed from their shells and are then again placed over the fire, where they are allowed to remain for from four to five hours longer. This process, although it is cheap and comparatively rapid, has the disadvantage of yielding a dark-coloured product which has a smoke-like taste and odour, and it also tends to form a hard, burnt coating over the surface of the nut while the inside is left in a comparatively moist state. Commercial copra, prepared in this way, contains from 9 to 13 per cent of moisture.

The hot-air method of desiccation has been used successfully for a long time in the preparation of coffee, cocoa, dried fruits, etc., and is at present in quite extensive use for

THE MAKING OF COPRA IN CEYLON,

where it is said to give a very pure, light-coloured product. The type of apparatus used in that island essentially consists of a large chamber filled with wire trays upon which the coconuts are placed and over which a current of hot air, driven by a fan, is passed. In Trinidad, there is now in operation a rotary hot-air drier which, it is stated, is better than any other apparatus now in use.

For the purpose of testing the efficiency of the stationary form of hot-air drier, a double-walled, rectangular galvanized-iron box, having an internal capacity of about 0·2 cubic metre was constructed. Three galvanized-iron trays, perforated at one end, were set in this box in such a manner that the stream of hot air, entering through a 20-centimetre pipe at the bottom, was compelled to pass over each in turn before escaping at the top of the apparatus. A constaut current of air was obtained by means of a small electric fan which was connected with a section of 15-centimetre pipe, so arranged that it could be heated by a small kerosene stove to any desired temperature. The apparatus had a maximum capacity of 24 nuts split in halves, or 12 nuts when shredded. In the first experiment four nuts were split in halves and placed on the bottom tray. The temperature of entering air was 56°C. and of escaping air 51°C. The time of drying was 20 hours. The copra dried at this comparatively low temperature was very white and of the best quality. A sample of oil expressed from it contained 0·08 per cent free acid.

In the second experiment the meat from twelve nuts was shredded by hand and treated for one day in the same manner as in the preceding experiment; it was then allowed to stand at room temperature over night and completely dried on the following day. The substance in the bottom tray naturally desiccated much more

rapidly than in the other two; therefore, as soon as one tray was completely dry, it was removed and replaced by the one just above it. The temperature of the entering air was 56°C. and of the escaping air 50°C. The actual time of drying was: Top tray, 14½ hours; middle tray, 12½ hours; and bottom tray, 9½ hours. The less completely dried copra in the two upper trays became slightly "soured" while standing over night. This caused a slight increase in free acid as follows:—Top tray, 0·32, middle tray, 0·15 and bottom tray, 0·13 per cent of free fatty acid.

In the third experiment the meat from four nuts was shredded and placed in the bottom tray, being stirred every half-hour. The temperature of entering air was 93°C. and of escaping air 74°C. The time of drying, 3½ hours. The copra thus produced was thoroughly dry, very white, and pleasant to the taste. The oil expressed from it contained only 0·06 per cent free fatty acid.

A fourth experiment was undertaken in an endeavour to ascertain the approximate time required completely to dry the fresh meat, introducing it at the top of the apparatus and shifting it gradually toward the bottom. Four trays, each containing the freshly grated meat of four coconuts, were prepared, and three of these were placed in the drier simultaneously, tray No. 1 being at the bottom. After the latter had become sufficiently dry, it was removed from the apparatus and tray No. 2 moved down to take its place; this was next replaced by No. 3, and finally in the same manner by the moist sample No. 4. The temperature of the entering air was 95°C. and of the escaping air 70°C. The actual time of drying was: No. 1. 4½ hours; No. 2, 5½ hours; No. 3, 6¾ hours; and No. 4, 4 hours.

In another experiment with a rotary drier a section of galvanized-iron pipe, 20 centimetres in diameter by 6 metres long, was set up on wheels and connected with a small electric motor so that it could be made to revolve at any desired speed. The same current of hot air which was previously used for the stationary drier was connected with this apparatus. Four strips of angle iron, extending throughout the length of the pipe, served to

KEEP THE MOIST COPRA IN CONSTANT MOTION DURING THE TIME OF DRYING.

It was found the grated meat from four nuts could by careful manipulation be dried in about 2 hours so as not to contain more than 6 per cent of moisture. The only objection to this method consists in the difficulty of regulating the speed with which the ground meat passes from one end of the apparatus to the other. When perfected, this method should prove the ideal one for drying coconut meat for oil-making purposes.

In several vacuum drying experiments the apparatus used was a small, barrel-shaped iron chamber, about 34 centimetres in diameter and in length, insulated with asbestos and heated by three hollow steam plates upon which the substance to be dried was placed. The pump connected with this drier gave a vacuum of about 660 millimetres (absolute pressure of 100 millimetres.) In the first experiment four coconuts (the maximum capacity of the apparatus) were split in halves, after removing the outer husk, and kept in the drier for three hours. The meat had then contracted sufficiently to allow of its being removed from the shell. During this time the temperature had gradually risen from 30° to 80°. The meat was then subjected to a further drying during four hours, at the end of which time, though not perfectly anhydrous, it was fully as dry as the ordinary commercial article. The actual time of drying was 7 hours; maximum temperature, 80° C.; vacuum, 635 millimetres; steam pressure, about 0·7 kilo per square centimetre (10 pounds). Other vacuum experiments showed that under the best conditions obtainable (temperature 85° and vacuum 635 to 660 millimetres,) the minimum time required for vacuum drying was five-and-a-half hours. It should be borne in mind, however, that the quality of the

COPRA PRODUCED BY THE HOT-AIR BOX DRIER IS VERY MUCH SUPERIOR

to that yielded by any other method, since it is perfectly white and dry, retaining the pleasant odour and taste of fresh coconut meat. For oil-making purposes the rotary apparatus, because it lends itself to a continuous process and requires considerably less time, recommends itself especially, although its product does not present quite so pleasing an appearance. Either of these two methods, on account of their cheapness and simplicity, should be preferred to vacuum drying.

Still another method of drying that has been suggested is "Centrifugating." This is to

EXTRACT THE MEAT FROM COCONUTS BY MEANS OF A ROTARY BURR

and to run this product directly into a powerful centrifugal, from which the greater part of the water would be thrown off at once. A comparatively short, supplementary drying by means of hot air would then suffice to prepare copra for expressing the oil. Another point in favour of this method is that copra resulting therefrom, having lost most of its sugar and albuminoids—together with its water—in the process of centrifugation, would be able to withstand a higher temperature while drying (with a resulting economy of time) without showing the same tendency to turn brown. Once dry, it could be stored with less danger of deterioration through mould action than material prepared by ordinary methods. The objection may be raised that during the centrifugation, a considerable amount of oil—together with the water—would be thrown off from the fresh meat, and that this would either entirely be lost or would necessitate much labour for its recovery. This, to a certain extent, is true, as the water in coconut meat exists in the form of a cream-like emulsion with oil, sugar, and albuminoids. A sample of this "coconut cream," prepared by expressing the fresh meat in a hand-press, was, on analysis, found to have a specific gravity of 1·012 at 30° C. and to consist of :—

| | Per cent. |
|---|---|
| Water .. .. .. | 56·3 |
| Total solids.. .. .. | 43·7 |
| Ash .. .. .. | 1·2 |
| Fat .. .. .. | 33·4 |
| Proteid (N + 6·25) .. .. | 4·1 |
| Total sugar as invert sugar .. | 5·0 |

The above results show that it approximates in nutritive properties the composition of a rich, natural cream; it is very pleasant and sweet to the taste, possesses an agreeable odour, and, when sterilised and properly sealed, will remain indefinitely in a fresh condition. Such a product could be used as a substitute for all of the purposes to which the so-called "evaporated creams," now on the market, are put; and it might prove to be one of the most valuable by-products of the coconut-oil industry.

The experiments enumerated above are both interesting and instructive, but it is to be regretted that they did not include at least one with air-dried, either by refrigeration or by contact with a hygroscopic substance in an anhydrous state, seeing that this affords all the advantages of drying at low temperatures while eliminating those associated with the rarification characteristic of vacuum drying.—*Indian Trade Journal*, Dec. 30.

## COCONUT BLEEDING DISEASE.

THE TREATMENT: CEYLON GOVERNMENT MYCOLOGIST'S ADVICE.

In the present instance the decay of the stem tissue is the direct effect of the attack of *Thielaviopsis*, as is proved by the inoculation experiments and the success of the treatment recommended. . . . The

DISEASED PARTS OF THE COCONUT STEM MUST BE COMPLETELY CUT OUT.

There is no difficulty in determining how much must be cut out, since the decayed tissue contrasts strongly with the healthy parts; but many people have expressed astonishment at the amount which is revealed when once the stem is cut open. Frequently a small black external patch is the only indication of an internal column of diseased tissue 6 feet long. If any diseased tissue is left behind, the disease will not be stopped; therefore it is usually advisable, in the case of long strands or cylinders of decay in the heart of the tree, to cut out about an inch or two of the sound tissue when the end of the strand has apparently been reached, in order to make quite certain that it does not continue as a narrow thread and then widen out again above. This is not so necessary on old trees where the disease is confined to the cortex. It is probable that in many native gardens the excision has not been thorough. The estate owner is accustomed to cut out "red beetle," and therefore adopted this treatment for the bleeding disease without much hesitation; but the native is so decidedly averse to cutting his coconut palms that the work may have been scamped in many cases. It redounds greatly to the credit of the inspectors that they have been able to persuade the villagers to overcome their prejudice in this matter.

THE BEST INSTRUMENTS

are an ordinary 1-inch chisel and a mallet. The extent to which the treatment had been adopted may be gauged from the fact that in February, 1908, it was impossible to buy either at one of the leading shops in Colombo. In some cases the cost of a chisel was said to be beyond the means of the villagers, and these were therefore lent to them. Several patent axes and gouges were put on the market, but none of them surpassed the ordinary chisel in efficiency; usually these cut out more than was necessary, and left the cut surfaces so rough that water lodged all over them. With a chisel the cut can be trimmed off, and the lower edge of the wound cut slanting upwards, so that the rain water drains away. The

EXCISED DECAYED TISSUE MUST BE COLLECTED AND BURNT AT ONCE.

Otherwise the fungus develops freely on it. This advice was unfortunately omitted from the Sinhalese translation of the first circular issued. In ordinary estate practice a piece of sacking is placed at the foot of the tree, and the chips fall on this. This method saves trouble in collecting, and secures that no pieces are left hidden among the grass.

ONE CAUTION

is necesssary when cutting out diseased tissue. On all coconut stems over twenty years old numerous circular red spots about 5 mm. diameter are seen when the outer tissues are cut off. These occur up to a height of 10 feet or more. They are not signs of disease, but merely incipient roots, and, needless to say, they should not be cut out. If holes in the coconut palm, especially in young trees, are left unprotected, they soon

ATTRACT "RED BEETLE";

this insect rapidly destroys the tree. Moreover, the soft inner tissues of the stem soon decay when exposed to the action of sun and rain. It is, therefore, necessary to protect the tissues with as permanent a covering as possible and for this purpose coal tar is undoubtedly the best. Tar is universally used in other countries ou pruning cuts and other stem wounds, but its use in Ceylon has been discredited, chiefly through misapprehension. In the early days of "cacao canker" many people simply painted tar over the diseased spots without previously excising the infected tissue. It was pointed out to them by the then Mycologist that this practice did not remove the fungus, which flourished unchecked beneath the coating of tar; and in order to secure the abandonment of such a futile method, and at the same time to enable planters to ascertain, whether the cooly had cut away all the diseased tissue, the use of tar was denounced rather forcibly. As a consequence, the idea has arisen that tar ought not to be used in any case; whereas it is really a most valuable means of protecting wounded surfaces, and only requires to be applied intelligently. In this respect the prosent treatment of the coconut stem stands on exactly the

SAME FOOTING AS THE TREATMENT OF THE CACAO SYSTEM.

There is no doubt that in some cases tar will hide bad work, but the abuse of the method is no justification for its wholesale condemnation. However, although tar may be dispensed with in treatment of cacao, it cannot in treatment of the coconut, owing to the difference in structure of the two stems. The former is able to heal wounds by the formation of new wood and bark

over them; the latter has no power whatever of healing wounds, and they must therefore be protected to prevent weathering or fresh infection. The wounds should be tarred immediately after cutting, if the attacks of "red beetle" are to be avoided. To facilitate this they should first of all be scorched or dried with a torch of rags dipped in oil. This process secures a better adhesion of the tar and at the same time burns off any fragments of the diseased tissue which may have been left. It is not necessary to char the tissues; the main object is to dry the surface. A rag wrapped for a length of about two inches round the end of a stick suffices for this, and gives a small manageable flame. The villager usually wants to use a dry coconut leaf; but this gives a large flame, which burns the surrounding healthy stem and sets up bleeding which may be mistaken for the stem disease. Kerosine is more manageable than coconut oil and is cheaper. The use of painters' lamps was recommended for drying the wounds in the case of large estates, but this has not, to my knowledge, been adopted. The tar is applied hot; this secures a penetration to a depth of about 5 mm. in young tissues. If the cutting has been insufficient, the tree begins to bleed afresh, the liquid emerging at the side of the old wound or through the tar. In such cases the work must be done again. In many instances small brittle globules of resin appear on the tarred surface; these have no connection with the disease, and should not be mistaken for renewed bleeding. When young trees are treated, the tarred surface frequently splits as the tissues dry and contract; and it is then necessary to tar them a second time, preferably using cold tar. It would be a

WISE PRECAUTION TO TAR ALL WOUNDS TWICE

with an interval of about three weeks between the applications; cold tar would adhere quite well to the dry surface on the second occasion, and would form a thicker covering than hot tar.

Up to the present this treatment has given good results. Some young trees, which were cut, but not tarred, have collapsed in a few weeks through the attacks of red beetle; but the danger of this seems to be small in old trees. In many cases the trees have had to be treated twice, but this is inevitable with cooly labour; on one estate which has 3,327 trees diseased. 352 have had to be treated a second time. Attacks of "red beetle" are, on the whole, rare, considering the number of trees which have been treated; tar appears to keep off this insect. In one instance the four-spotted coconut weevil bored through the tar and honeycombed the underlying tissues, even though these were saturated with tar oils, but the excision of all the affected tissue, together with the beetle larvæ, prevented the destruction of the tree. One planter complained that the wounds were attacked by woodpeckers, but it is most probable that beetles had obtained an entry previously. In order

TO PREVENT INFECTION OF YOUNG TREES,

spraying with Bordeaux mixture was recommended. This was done on many estates, but I have not been able to obtain details of the cost of the operation. Sprayers were used in one instance, but in most cases it was found cheaper to apply the mixture with a brush. Experiments have shown that the spores of *Thielaviopsis* do not germinate in a solution which contains more than 0·06 per cent. of copper sulphate; spraying with Bordeaux mixture will, therefore, prevent infection, though the solution is not strong enough to kill the spores. It was pointed out in the local press that bazaar samples of copper sulphate contained about 75 per cent of iron sulphate; Bordeaux mixture made with this is black instead of bluish white, and is practically worthless. In most cases the amount excised in the eradication of the disease is so small that it can have no effect on the future growth of the tree. Where long wounds have been made in young trees, the supply of water and food materials from the roots is interrupted, though not to the extent it would be indicotyledonous trees, because the wound follows the direction of the vascular bundles, and though oblique, hardly destroys more bundles than enter the base of the diseased tissue. But since the coconut is adapted for existence on a small supply of water and its vascular bundles are very numerous, it may be doubted whether this effect will be perceptible, because the extra work thrown on the remaining bundles will be small when divided among so many. It has been prophesied that the stem will become gradually thinner above the wound, but I can see no reason why this should occur under modern estate cultivation.

THE GREAT DANGER

is that the stem should be so weakened by cutting that it breaks with the wind. This is hardly likely to occur if the wound is near the base, but an estimation of its probability in other cases requires an investigation into the tensions of a coconut stem on bending—a very interesting problem, but one which cannot be entered into here. There is scarcely any bending with the wind in a coconut stem about twenty years old; after this the amount increases with the height, the lower quarter or third usually remaining immovable. The theory that the palm stem does not curve in a gale but bends from the base from a position to a position is quite erroneous in the case of the coconut; the latter bends in a uniform curve, and the crown sways like the bob of an inverted pendulum, the motion of the stem being imperceptible in the lower quarter or third according to the height of the tree. The elongation of the stem with age alters the bending moment at any point, and therefore a wound which is not a source of weakness at first may become such as the tree grows older, quite independently of any further decay at that point. Personally I have only seen trees broken by the wind when the stem was over 60 feet high, and the disease occurred within the upper 10 feet; the number of coconut palms uprooted by gales appears to be far greater than the number broken.

Holes made when cutting out "red beetle" are often filled with lime; this serves at least to prevent further beetle attacks. It has been suggested that the holes made in carrying out the present treatment should similarly be filled with cement or earth, but there does not appear to be any advantage in this practice. In

all the cases which I have seen the cement has dried into a compact mass quite free from the wood. In such a condition it cannot add anything to the strength of the tree; and the rain water which lodges behind the cement soon induces decay. It is better to slope the lower edge of the hole so that rain water will not lodge, and to leave the hole open.

Though the prescribed treatment has been adopted, there have been many suggestions that it ought to be possible to discover some more conservative treatment, *i.e.*, some method which does not involve excision of the diseased tissue. Needless to say, no hope of such a treatment has ever been held out. The idea which underlies these suggestions in every case is that it should be possible to water the roots of the tree with some solution which will eradicate the fungus without injuring the tree. Such an idea has not escaped the imagination of mycologists; but in spite of many years of experiment, the internal application of fungicides has not met with the slightest success, whether they have been applied as liquids to the roots or as liquids or solids in holes in the stem. In the present case

ANY SUBSTANCE WHICH WOULD KILL THE FUNGUS WOULD UNDOUBTEDLY KILL THE TREE IF APPLIED TO THE ROOTS,

or would locally kill it if inserted in healthy tissues. Moreover, even if it killed the fungus without damaging the healthy tissue, there would be left a mass of decayed tissue within the stem, to act as a nidus for other fungi when the fungicide had disappeared. It is impossible to convert the diseased tissue into sound tissue again, though such a claim has been recently made in Ceylon. Further, if the fungicide is inserted into the decayed portion of the stem, it can do very little harm to the fungus, for the bundles which convey liquids up the stem are here interrupted, so that it can only penetrate the wet rotting mass by diffusion; and that process is so slow that the fungicide would never overtake the advancing fungus.

Further suggestions which have been made for treatment of the bleeding disease will be considered later.—*Peradeniya Circular*, Vol. IV, No. 22.

---

The long expected Peradeniya Gardens circular of Mr. T. Petch, the Government Mycologist, on the subject of the Coconut Bleeding Disease, from which the foregoing is extracted—will be read with considerable interest by a large number of coconut planters. The completeness of its contents will be seen from the following list:—

Historical and general; the structure of the coconut stem; the effect of the disease; influence on the crop; the distribution of the disease; the size of the coconut stem; the cause of the disease; the fungus; the growth of the fungus on coconut tissue; general biology of the fungus; effect of various chemicals on the growth of the fungus; treatment; methods of infection; the manufacture of coir; other causes of bleeding; suggested causes of the disease; suggested remedies; the fungus in other countries; resistance to disease; miscellanea; the use of salt.

The circular, which makes a record for this publication, numbers no less than 110 pages, and contains several valuable illustrations, the first being of a coconut tree which has had bleeding disease on it for more than two years. The second shows the black external patch on the stem, and has a cross section showing decayed strands. The third gives a plantation on which the old scars of the bleeding disease are distinctly visible on the trees. The fourth represents a striking specimen of an old scar of the bleeding disease with a fresh patch started near the top. The first two sections of the circular do not call for much reference or comment; but the third, on the effect of the disease, is one which will be looked to first and must be studied in detail. Mr. Petch finds it difficult to decide how much of the tapering in the case of poorer trees is due to the effect of age and how much to the wounds consequent on dealing with the disease. In the fourth section he finds there is no reason to think that the crop is reduced where the trees have been lightly affected, and the controlling factor in the fluctuations of crops still remains the weather. The section on distribution of the disease will interest proprietors and it will surprise many to learn that the total number of diseased trees reported is no less than 208,184, all of which have been treated, with few exceptions, but even this number is doubtless below the mark. The sixth section on the size of the coconut stem is one partly of academic interest, but the information in it will be useful to any planting up fresh acreages—the advice in planting being to set the nuts close to each other and in a slanting position, trees from these nuts, apparently, not having a swollen base, which is so much waste material. The section on the cause of the disease points to a fungus, known to cause a similar disease in sugar cane, being responsible. It is entitled "Thielaviopsis ethaceticus." Section eight gives a very scientific account of the fungus and section nine explains the reason why the fungus grows freely only on the coconut stem, namely, because (ignoring the inflorescence) that is the only tissue containing appreciable quantities of sugar as such. The biology of the fungus is gone into at length and the preliminary results of experiments still in progress with various chemicals on the fungus growth are presented. It seems to be proved that an immersion of spores of 15 minutes in one per cent of carbolic acid kills them. The most valuable section is that which deals with treatment of the disease; this we have quoted above. The methods of infection also require careful study even if special coolies cannot be assigned, as advised, to inspection duty only, and for marking diseased trees. No danger, it appears, is to be feared from the manufacture of coir from diseased trees. Other causes of bleeding than the fungus are detailed, while still further causes are suggested though not actually proved. The section dealing with suggested remedies disposes of several which have been accepted hitherto, explaining why they must be discounted and abandoned. The last sections, which are mentioned above, are perhaps less important but should also be examined to round off one's knowledge of the coconut tree. The one on the use of salt summarises the information available from various sources up to date.—T. PETCH, B.A., B.SC.

## TEA AND RUBBER: IN JAVA AND BRAZIL.

### NIRMALA (JAVA) PLANTATIONS.

The statutory general meeting of the above was held on Monday at the offices of the London Chamber of Commerce, Oxford-court, E.C.

Mr WALTER HILLIERS—(chairman and managing director) presiding said: [after preliminary remarks]. The

FIRST CONSIGNMENT OF THE COMPANY'S TEAS

has been sold, and I am glad to say they have fetched very satisfactory prices—better than we expected. Quite independent of the market, we hear that the teas have really found favour with the buyers. The work of opening up both for tea and for rubber is being pushed forward, and a fair area will be opened up and planted this year. The representative of the secretaries (Messrs Rowley, Davies & Co.) has since the formation of the company paid various visits to the estate, and in every report he has made he states how very much impressed he has been with the possibilities of this estate, and that it has really a magnificent future, as he puts it. I should also inform you, as I know it will be of interest, that it came to our knowledge that a very few days after the property was purchased by this company—but before the sale was known in Java—an offer of considerably more money was made for the property than we have paid for it. In fact, the difference was stated to us, but I do not think it would be fair to those concerned if the amount were mentioned publicly. This, I think, as far as we are concerned, closes what I have to say with regard to the estate itself; but there is also another matter I should like to touch upon, as it certainly is also of importance to the shareholders, and that is the

EXTRAORDINARY DEMAND FOR LAND SUITABLE FOR TEA CULTIVATION

which has sprung up during the last few months in the island of Java, and, as a consequence, the value of the land has gone up very materially indeed. One hears from many quarters attempts at estimates of what the output of tea from the island of Java will be in such and such a time, and various forecasts are given as to the revolution which the Island of Java may produce in the tea world. I think that a great many of the forecasts are entirely fantastic. The extraordinary crop that is expected by some from Java can, in my opinion, never be obtained, because the

AREA OF LAND AVAILABLE AND SUITABLE FOR PLANTING TEA IS VERY LIMITED

indeed, and, considering what the output is now, those figures which are often forecasted I am confident cannot be reached. There is, however, another aspect of this question which is of more interest, in my opinion, and that is the great improvement in the quality of Java tea which has taken place in the last few years. This matter is receiving more and more attention in the island by the planters, and, as every one who is concerned in any way with tea selling or tea buying knows, the

IMPROVEMENT IN THE QUALITY OF JAVA TEA

in the last few years is most marked, and is progressing, you might say, from season to season. Considering that this improvement is obtained at a very small increase in cost, if any at all, I think that this tendency speaks very well for the future success of any tea undertaking in Java.

### JEQUIE RUBBER SYNDICATE.

The ordinary general meeting of the above was held on Friday, at the offices, 30, Mincing-lane.

Mr L T BOUSTEAD—chairman—presiding said his task would have been a much easier one if he had had an opportunity during the past year of visiting the estates. . . .

Both as regarded the plantations and the rubber forests the

ESTATES WERE WITHOUT DOUBT THE FINEST IN THE PROVINCE.

Their area was upwards of 80,000 acres, and they had about 540 acres planted with rubber trees ranging from three to five years old, and a further 60 acres or so cleared, which would be planted up in the wet season. Mr Frank estimated that the

PLANTATIONS CONTAIN SOME 325,000 TREES,

which was a very considerable asset. With regard to the rubber forests, the results of clearing some 236 acres had been of a most satisfactory nature. They averaged about

300 TREES TO THE ACRE,

and Mr Frank wrote that he had several thousand acres of forest equally rich in rubber trees. Comparing these figures with those of the best of African forests the number of trees was very great, for there, he believed, they could not boast of more than 25 trees to the acre. He was bound to recognise the fact that the *funtumia elastica* was a more valuable rubber than the Jequié, but the latter, as the brokers' reports showed, if shipped in regular quantities and in the form of the samples which had been sent over, would fetch a very good price indeed. In fact, they hoped, with the additional machinery which had been sent out, to obtain an

AVERAGE NOT FAR SHORT OF THAT OF EASTERN PLANTATIONS.

Shareholders might be surprised at such a small area having been cleared during the past year, but it must be remembered that the syndicate started with a very small capital—only £5,000 being available for working capital. Since the date of the balance-sheet the working capital had been increased to £12,000; with the

CLEARING OF THE FOREST COSTING WELL UNDER £1 PER ACRE,

they ought in the coming year, and the year after, to be able to make very considerable extensions. They had only indicated an extension next year of 1,000 acres; but he saw no reason why, when the tapping season was over, they should not clear the undergrowth from at least 2,000 acres and possibly more, as ample labour was procurable. They had asked Mr. Frank to make a census showing number and girth of rubber trees, and this would be of great value in framing future estimates of crop. Mr. Frank estimated that he had a

FURTHER 3,000 ACRES IN THE ABOBORAS VALLEY equal to what he had already cleared. Based upon what had already been done, 50 lb. an acre appeared to be a very conservative estimate of yield from the cleared forest to start with, and, of course, there would be annually an increasing number reaching maturity, so that the yield should increase correspondingly, quite apart from the increase derived from planting up. Their policy should be to extend the clearing of the undergrowth as rapidly as possible until they had from 3,000 to 5,000 acres of cleared forest. Planting could be done at the rate of about 500 acres a year, or according to the season. On the basis of an acre producing only 50 lb of rubber, and supposing it sold at a profit of only 1s 6d per pound,

EVERY ACRE OF FOREST SO CLEARED SHOULD IN ITS FIRST YEAR, GIVE THEM A PROFIT OF £3 15s, this being on the small capital outlay of £1 to clear it. (Applause.) They had based their estimates of yield on the trees giving not more than ½ lb. to commence with, which was what Mr. Scaldaferri said they averaged in the wild state, though many would give a much higher yield than this. The yield varied considerably in the Manihot variety, just as it did in the Hevea variety. Mr. Frank told them of a tree from which he extracted as much as 20 lb. or 22 lb, and it was from this that he took the seed for these plantations. They had had several orders for seed; and if it did all that was expected of it this syndicate would do very well. Up to the present it might fairly be said that Mr. Frank had proved the accuracy of his estimates of cost. With regard to the cost per pound of the rubbor, he stated when he was home last year that he could land it in Bahia at 1s per pound from the plantations, allowing an extra 4d per pound from the cleared forests; but to provide against all contingencies the directors preferred to

BASE THEIR ESTIMATES ON ITS COSTING 1s. 6d. PER POUND F.O.B.

A good deal had been said to him (the chairman) at different times about the inadvisability of cleaning their rubber locally, and that it would be much better to send it home in its rough state and let the manufacturer do his own cleaning; but the results had certainly shown that it was quite possible to clean the Jequié rubber on the spot, ship it home, and get an excellent price for it. They certainly did not propose to send home any dirty stuff such as it was customary to send from Bahia generally. (Hear, hear.) With regard to the cost of the plantations, Mr. Frank went carefully into the estimates with him a year ago, and the results he arrived at were that, allowing for all contingencies, he could plant and bring an acre of rubber into bearing for a little over £7. Another question of interest was that of

COTTON GROWING.

Bahia used to export considerable quantities of cotton. Mr Frank wrote that if they would put up a mill on the estate, as soon as it became known the natives would start planting cotton on their own account for 50 miles round, and bring all their cotton to him. Mr Stevenson was of opinion that this would prove quite a profitable business. Mr Railton, who had had experience of cotton growing, would go into the matter on his arrival. The directors had been approached on the subject of disposing of a portion of the Company's estate. Negotiations were proceeding, and he had reason to believe that the matter was likely to go through at an early date, to the great advantage of this syndicate. If the arrangements which had been suggested were carried through, the syndicate would be provided with additional working capital for the development of the forest, and it would also give them a large interest in another Company developing their own estates. (Applause.) As it would be their idea to take the greater part of the purchase price in shares, they would be interested in giving the new company the best part of the forest, without entrenching upon the Aboboras valley, which they themselves were developing. Summed up, the position was that with the increased working capital now available they were pushing ahead in clearing the forest as rapidly as possible, and that would be their policy for the future. Meanwhile tapping of both the plantation and the forest areas as cleared would be the principal work in hand from November to April.

## RUBBER EXPLOITATION IN BRITISH EAST AFRICA.

An application for a concession to tap rubber from the wild landolphia rubber vine over a forest of 25,000 acres, writes Mr H W Buckland in the January *Empire Review*, was declined solely on the report of the Forest Officer, that my friends and myself might make an income of £30,000 a year from the concession—a totally erroneous conclusion; but, even if correct, as the Government was to receive a 10 per cent. royalty plus a rental without expending a penny of capital, what objection could there be? I should perhaps say in connection with this application that the Government agricultural expert strongly recommended the granting of the concession on the ground that the forest was being destroyed by the excessive tapping of the vines by natives, who pay no royalty or rental whatever.

## THE EXAMINATION OF NYASALAND TOBACCOS

of the "barn-cured" pipe class—received at the Imperial Institute lately—indicates that they are of particularly promising quality and that a considerable measure of success has been achieved in the solution of the difficult problem of producing, in a new country, so far as tobacco production is concerned, types of tobacco similar to those in demand in Europe. The appearance of the tobacco, which is a very important matter, is regarded as satisfactory by the firms consulted. The characteristic aroma and flavour produced when these tobaccos are burned, which are slightly different from those of similar American tobaccos, will probably prove the chief difficulty in the way of finding an extended market for them in Europe.

## PROFESSOR FITTING ON THE TAPPING OF "HEVEA" RUBBER.

EXPERIMENTS IN JAVA BOTANIC GARDENS.

We are glad to publish below a good summary of a lecture delivered by Professor Fitting of Strasburg on the tapping of *Hevea* Rubber—the result of experiments at Buitenzorg Botanic Gardens, Java. The fact that incisions should not be retapped till the bark cells and wood are refilled with "reserve material" may not be new to many rubber planters; but the scientific way the conclusion is arrived at, and all the connected deductions, are well worth studying—especially his *caution against the pricker* and the view that the herring-bone method (double better than single) is the best.

---

Some 18 months ago a German Professor from Strasburg, Professor Fitting, made some interesting studies at Buitenzorg on the tapping of Hevea rubber trees, and an interesting lecture was recently delivered before the Malangsche Agricultural Society by Dr. Th. Wurth on the results obtained, a summary of which appears in the *Cultuurgids.* According to Prof. Fitting

EVERY TAPPING METHOD IS MORE OR LESS INJURIOUS

to the plant, for by incisions in the bark the transport of the feeding material of the tree is broken. Both the roots and the foliage play a large *rôle* in the sustenance of the tree. The former takes up water, and at the same time the salt therein is dissolved; the crown of the tree turns the carbon, which is obtained from the carbonic acid gas of the air, into sugar. Out of the salt and sugar the plant forms building material, which for its life and growth is of the greatest importance. It has been shown that the water with its salt mounts through the wooden part of the stem; the building material formed in the crown of the tree, which must be transported to all parts of the plant, including the root, descends through the bark. Further, it is

IN THE WOODEN PART OF THE STEM AND THE BARK THAT THE RESERVE QUANTITIES OF BUILDING MATERIAL ARE STORED.

Whenever the conduct of tho sap is broken by any damage to the tree, then the growth of the stem and root is carried on by means of the reserve store until the damage is made good. The Professor demonstrates this conclusively by experiments. If a circular incision reaching to the wood is made, the tree, of course, at once endeavours to close this by the formation of tissues; if it succeeds, the sap is carried to the bottom in a normal way and the tree prospers again; if it fails, the root does not receive its proper share of building material, it pines and cannot fulfil its functions, and finally the tree sickens and dies. In the tapping of a rubber tree such serious wounds are, of course, not made; but the same principle brings about similar results and in the case of an oblique incision, as, for example, by the fish bone method—the transport of the sap is at once interrupted. The plants sets about restoring the sap transport by forming new tissues. For this the reserve stocks deposited in the bark and wood are first used. Professor Fitting showed that in the entire neighbourhood of the wound in both bark and wood, the sap had vanished. He, therefore, comes to the conclusion that

AN INCISION MUST NOT BE RE-TAPPED

after the first tapping period

UNTIL THE CELLS OF BARK AND WOOD ARE AGAIN FILLED WITH RESERVE MATERIAL.

The professor did not stay long enough to find out how long this takes, but he supposes that more than a year, perhaps even two years, is needed before the new bark can be tapped for the second time.

Thus all tapping methods must be condemned whereby too large a portion of the stem surface is tapped at the same time, for thereby too much sap-transport is broken, and there is a risk that the root will not be provided with sufficient building material. For this reason the

SPIRAL METHOD, FOR EXAMPLE, SHOULD BE ABANDONED.

Professor Fitting advises that a cutting only a quarter of the stem circumference broad shall be first tapped. The tapping of this incision lasts five to six months (first tapping period). Thereafter the tree is allowed to rest for six months. Then begins the second tapping period and at the opposite side of the stem, again followed by a resting time of six months. The third and fourth tapping follow on the same lines, If it appears in the case of old trees that the latex does not decrease in either quantity or quality, then it is better, instead of making the incisions wider, to shorten the term of rest between the various tapping periods, so that after three or even two years the planter comes back to the incision first tapped. We see here that Professor Fitting emphasizes the necessity for a sufficient surface of untapped incisions. The Professor also utters a warning regarding the suitability of the pricker, for the new bark formed after prick-wounds contains many stone-cells and few milk-sap vessels. Beside this, the wound tissues swell out, producing an uneven surface, which is a disadvantage in tapping. Professor Fitting thus comes to the following

CONCLUSIONS:—

(1) Tapping methods which largely or wholly break the horizontal moving of the sap-stream from the crown to the base of the tree are to be condemned, viz., tho spiral method, the V-shaped incisions without collateral spaces between, the double fishbone method over the whole stem surface, and the two half-fishbones—in so far as they extend over the whole circumference.

(2) A sufficient number of untapped, not too small (straight) incisions, must be allowed to stand until the tapped incisions are again in a state to transport building material (for this, perhaps one to two years are necessary).

(3) Methods with long cuttings are to be deprecated, as the building material moves only very slowly in an oblique direction.

(4) Of the various tapping methods the herring-bone seems to be the best (with four periods).

(5) The double herring-bone is to be preferred to the single.

(6) Caution must be exercised as to the suitability of the pricker.—*L. & C. Express*, Ded, 24.

## CEARA RUBBER TAPPING DIFFICULTIES IN SOUTH COORG.

13th Jan.—Tapping of large old Ceara trees that are to be found in the district, as also those of later plantings which have reached the minimum tappable girth, has been in progress since November last in most cases. In one it was commenced somewhat earlier. Various methods of tapping and knives are being experimented with, with a view to arriving at what is best suited to the trees. The yields of rubber have been very encouraging, but some of the older trees have fallen victims to the bamboo weevil in spite of every effort to prevent injury to the cambium.

Now that the Ceara rubber is reaching the tappable stage, some arrangements will have to be made for securing larger supplies of intelligent labour. Mr Anstead, the Scientific Planting Officer, during his recent visit here has revived the interest in leguminous weeds which he aroused by his lecture at the last meeting of the U.P.A.S.I. There are a good many shrubs of the order about, but what is required is a weed, and we are all on the look-out for one. —*Madras Times.*

## RUBBER AND TAPIOCA.

(*To the Editor,* "*Straits Times.*")

Sir,—I have read with interest your article on the Sedenak Rubber Estates flotation: you are quite right in doubting the value of the contract with Sit Keng Saick: the company will lose by it. It is stated that by the time two crops of tapioca are out of the ground the rubber trees should be 3 to 3½ years old: quite so, but what will the growth of the trees be like? I leave it to anyone to answer this question, who has seen rubber and tapioca growing together on an estate under Chinese management. How long after the rubber is planted, is the tapioca to be put in? At least 6 months should be allowed; otherwise the rubber will be choked by the tapioca. I notice that the cost of production is put down at $5·85 per picul of tapioca: if this is correct, I can assure the shareholders there will be no 10 per cent. profit for them: the cost of production should be nearer $3. I know of an estate in Malacca, where a contract was given out on similar terms as to weeding, etc., but the lessee had to pay 25 per cent. of the gross proceeds of the tapioca sales to the company; even then it was found after six months that he was "scamping" his work, neglecting weeding, etc., and the contract had to be cancelled. Those parts of contracts look very well on paper: but never work out well in practice. Further, during the time the tapioca crop is in the ground: it is impossible to keep a proper look-out on the rubber trees, and check certain diseases, which affect the Para rubber tree, especially in heavily timbered land, such as I understand this to be. £10 to £12 an acre for felling, burning and clearing seems a bit "thick": the proper rate should be £2 at the outside. Who is to get the proceeds from sale of the tapioca refuse? This should be worth a good deal, considering the situation of the estate.—I am, Yours, etc.,

Malacca, Jan. 5. SAWNY.

—*Straits Times*, Jan. 10.

## INDIA RUBBER MARKET REPORT FOR 1909.

(*Gow, Wilson & Stanton, Limited.*)

SALES.—The quantity of Plantation Rubber, which passed through the auctions during the year under review, aggregated 50,602 packages (2,684 tons), as compared with 24,647 packages (1,295½ tons) for the year 1908. The rate of increase since 1906 is shown in the table given below; and the course of the market during the last four years is given in a chart [Not reproduced.—ED. *C.O.*]

The average price for all grades of Plantation Rubber for the year has exceeded that of 1908 by 2s 5 5-8d per lb.

Table showing total quantity and average price of Plantation Rubber offered at auction in London during the last four years:—

| | | Packages offered. | Quantity in tons. Ceylon. | Malaya. | Total. |
|---|---|---|---|---|---|
| 1st Jan to 31st Dec, | 1906 | 6,462 | 98¼ | 250¼ | 348½ |
| Do | 1907 | 15,380 | 192½ | 62[illegible]½ | 814 |
| Do | 1908 | 24,647 | 290 | 1,00[illegible]½ | 1,295½ |
| Do | 1909 | 50,602 | 432 | 2,252 | 2,684 |

| | | Packages sold. | Average price. s. | d. |
|---|---|---|---|---|
| 1st Jan to 31st Dec, | 1906 | 4,130 | 5 | 6¼d |
| Do | 1907 | 7,[illegible]88 | 4 | 9 5-8 |
| Do | 1908 | 16,018 | 4 | 1¾ |
| Do | 1909 | 40,877 | 6 | 7 3-8 |

MARKET CONDITIONS.—At the beginning of the year the conditions which ruled during the earlier part of 1908 had been reversed: whereas the stocks and visible supply of all descriptions had then been on an unwieldy scale and prices abnormally depressed, from the end of 1908 a steady curtailment of supplies was taking place in all markets with a corresponding advance in values. The demand for the raw article, which was active at the beginning of the present year, became steadily stronger, until during September and October the highest prices ever recorded were reached, in the case of Hard Fine Para 9s 2d having been paid and 9s 8½d for Fine Plantation Smoked Sheet. The arrival at the South American ports of shipment of larger supplies during November re-acted on the price and caused a set-back to the extent of approximately 2s per lb. from the highest point. During the latter part of December the market has been more active with a strong recovery of prices. The very marked indications of increase in the consumption of rubber in face of adverse conditions have been a noticeable feature of the period under review. This tendency is likely to be maintained, especially in view of the remarkable expansion which is taking place in the Motor Industries all over the world.

PLANTATION RUBBER—has engaged a large and increasing measure of attention amongst manufacturers, and it may already be said to have assumed an important position in the world's markets, although the quantity produced is still perhaps

ONLY 6 PER CENT OF THE WORLD'S PRODUCTION.

Consumers now generally realise that a considerable quantity will be available in the

near future, owing to the great stimulus which has been imparted to the Industry by its substantial profit-earning capacity. The popularity of Plantation Rubber with buyers has been well manifested by the large number of contracts which have been entered into for delivery up to the end of 1910 (and in some cases to the end of 1911) at prices ranging up to about 8s per lb. The general quality of the Rubber produced has fully maintained its previous reputation, the care given to its preparation by planters, especially as regards cleanness, has been appreciated.

Buyers are giving more attention than ever to the characteristics of strength and toughness, and these are by far the most important properties that the grower must strive to secure. The popularity of Highlands and Vallambrosa Smoked Sheet, on account of its strength and evenness in quality, has resulted in the highest prices being generally now paid for these kinds. This has drawn considerable attention to the

ADVANTAGE OF ADOPTING THE PROCESS OF CAREFULLY SMOKING

the Rubber, and a large number of planters are now engaged in experimenting in this direction. The commonest form of Plantation Rubber now on the market is Crepe, which has been so largely adopted on account of economy in handling and the good results obtained. Sheet still comes forward in fairly large quantities, Biscuits being almost entirely limited to small shipments from Ceylon. The demand for very pale coloured pure Rubber, which was such a feature last year, has been eclipsed by the recent competition for smoked Sheet, which has so far only been coming forward in small quantities. Buyers however are still ready to pay full prices for Light-coloured Rubber, whether in the form of Crepe, Sheet or Biscuits, when of even quality.

PRODUCTION. PLANTATION RUBBER.—The quantity exported this year, from the various countries of production shews an increase of roughly 100 per cent on the figures for the previous 12 months, the increase in the case of Malaya being much more in proportion to that of Ceylon.

PARA.—The season 1908/1909 produced about 1,500 tons more than the previous one, the crop being the largest yet recorded, while the first six months of the present crop mark an increase of about 835 tons over the same period last year.

EXPORTS OF PLANTATION RUBBER FROM MALAYA AND CEYLON SINCE 1905.

| | Port Swettenham. | Singapore. | Penang. | Ceylon. | Total. |
|---|---|---|---|---|---|
| | Tons. | Tons. | Tons. | Tons. | Tons. |
| 1905 | — | 83 | 47 | 75 | 205 |
| 1906 | — | 327 | 58 | 146 | 531 |
| 1907 | — | 649 | 236 | 248 | 1,133 |
| 1908 | — | $919\frac{3}{4}$ | $719\frac{1}{4}$ | $371\frac{1}{4}$ | $2,010\frac{1}{4}$ |
| *a*1909 | 1,339 | 1,103 | 986 | 597 | 4,025 |

*a* The December figures (and part of those for November) are estimated.

RECEIPTS AT PARA DURING THE LAST TEN SEASONS.

| | | Tons. |
|---|---|---|
| 1899-00 | .. | 26,693 |
| 1900-01 | .. | 27,640 |
| 1901-02 | ... | 29,99[illegible] |
| 1902-03 | .. | 29,890 |
| 1903-04 | .. | 30,580 |
| 1904-05 | ... | 33,100 |
| 1905-06 | .. | 34,710 |
| 1906-07 | .. | 37,810 |
| 1907-08 | .. | 36,680 |
| 1908-09 | ... | 38,150 |

RECEIPTS FROM JULY TO DECEMBER FOR THE LAST FIVE YEARS.

1905, 14,690 tons; 1906, 14,680 tons; 1907, 14,240 tons; 1908, 15,765 tons; *a*1909, 16,600 tons.

*a* Up to 29th December.

GOW, WILSON & STANTON, LTD., 13 and 23, Rood Lane, E.C., 31st December, 1909.

---

## AMAZON VERSUS PLANTATION RUBBER.

In the *Journal d' Agriculture Tropicale* (September, 1909) M. G. Lamy Torillhon discusses the causes of the difference in value between hard cure Para of the Amazons and plantation Rubber. He says that a manufacturer of fine para, if offered hard cure, knows right away that the product is fine, older collected, and drier than Island Para, which is wetter and valued a little lower. With plantation rubber it is necessary for him to see and even analyse the samples before fixing the price. The Brazil rubber contains 15 to 20 per cent. of foreign matter and water, while plantation rubber is quite pure and only gives ½ to 1 per cent. of moisture, yet the price of the former is higher. He gives an explanation of the difference between the texture of the two rubbers in the following way: Pure raw caoutchouc is considered as composed of globules agglutinated by a physical or chemical method when they were in suspension in the latex. It is by a kind of coalescence that they are joined together, they then present themselves under two conditions of matter very distinct and complementary. One of these states corresponds to a fibrous, elastic, nervous matter, the other may be compared to a plastic matter always ready to unite with the former. The molecular arrangement is so well done that one might compare it to threads of chain joined by a weft, if the comparison of the rubber to a tissue is not too hazardous. It is just in "fine Para" that one finds the highest degree of perfection in this combination of the two substances.

He attributes this greater strength and nerve possessed by the Amazon rubber to the practice of smoking. Unfortunately, says he, smoking does not exist or is at least very little employed in the Federated Malay States. We have only seen some attempts which should be followed up, for we are persuaded that rubber prepared by smoking should produce a notable increase in value, high enough to induce the collector to persevere on these lines. It appears to us indispensable that the collectors of plantation rubber should make smoking general. They would by this means give to their rubber a quality which manufacturers would welcome.

He points out the important factor of the age of the trees, a fifty-year old tree giving more elastic and nervous a rubber than a ten-year old one, but this with respect to the difference between plantation and Amazon rubber, as he says, time will cure.

As to form, he profers block, condemning crepe on the ground of its liability to collect dust and damp, and to favour oxydation and tackiness. Biscuits are bettor, but evon they expose too much surface to the air.

The question of smoking rubber is decidedly coming more to the front now-a-days. In the very early days of rubber cultivation, smoking was not uncommon. The first lots of Biscuits sent from the Botanic Gardens to manufacturers were regularly smoked, but this form was rather darker in colour than unsmoked rubber. Amber biscuits took the fancy of the home market. They were very attractive in appearance and so transparent that the buyers could see that they were pure and free from dirt. Then came a reaction, and darker colouring was not considered a defect. In fact, lately smoked rubbers have fetched the highest price in the market. The smoking hitherto however, has only been on the outside of made-up biscuits and sheet, its advantage being the more rapid drying and the prevention of external mouldiness especially in wet weather. However, for a year, experiments in smoking the latex itself have been in progress in the Botanic Gardens, and we hope very shortly to lay the results of these before our readers. A number of blocks of rubber thus prepared have been submitted to some of the best manufacturing firms in Europe, and their reports will be published whon they aro completed. We may say, however, that the rubber thus produced is very different in firmness and nerve from the ordinary plantation rubbers, and more resembles the best hard cure rubber from the Amazon.—Ed.—*Straits Agricultural Bulletin*, for December.

## A WONDERFUL MEXICAN RUBBER.

"Palo Amarillo"

(*Euphorbia fulva*, Stapf ; syn. *E. elastica*, Altamirana and Rose, not of Jumelle).—Some particulars regarding this plant as a new source of rubber appeared in the *Kew Bulletin*, No. 7, 1907, p. 294. The following supplementary information upon the subject is gathered from an illustrated article on "The Rubber Plants of Mexico" by Dr. H H Rusby in "Torreya" Vol. 9, No. 9, September 1909. From this papor it appears that the "Palo Amarillo' will not grow upon the alluvial plains of Mexico but only on the rocky hill-sides where tho drainage is good. The bark is describod as being thick and succulent at first, smooth, and of a light yellowish-green colour. That of the trunk and large branches soon excoriates in large, very thin, papery, translucent sheets of an orange-yellow or orange-red, colour, which impart to the tree a shaggy appearance, and a colour that has given the trunk its vernacular name "palo amarillo" or yellow trunk. Tho flowers appear in January or thereabout, before the appearance of the new leaves, and the fruits mature in June and July. As soon as the bark is wounded, a milky juice exudes, which is very irritant and capable of producing violent inflammation of the oyes if it enters them, as it is quite liable to do in spattering, when the tree is cut. The great value of this tree as a rubber producer lies in its abundance over large areas and the proximity of the trees to ono another facilitating collection of the milk, as well as the ease with which it can be propagated and the rapidity of its growth. All that is necessary for propagation is to thrust the newly-cut branches into the soil, where they practically all grow. From them the treo reaches its full size in from 5 to 7 years. These considerations appear to incline Dr. Rusby to the opinion that

IF ALL OTHER SOURCES OF RUBBER WERE TO FAIL, THIS ONE COULD PROBABLY SUPPLY THE WORLD'S ENTIRE REQUIREMENTS.

The properties of the "palo amarillo" rubber are peculiar. Taken by itsolf it is of only medium quality, but mixed in suitable proportion with other varieties, especially with para rubber it markedly improves them.—J. M. H. —*Kew Bulletin*, No. 9, 1909.

## RUBBER PLANTING AND EXPLOITATION IN BAHIA, BRAZIL.

Mr. L. T. Boustead, the ex-Ceylon planter, has had varied fortune as a Company director --holding this position on the Attapadi Tea and Rubber, and Batu Tiga (Selangor), Imperial Ethiopian, Kepitigalla and Shelford Rubber Companies. The Abyssinian concern, over which he was able to obtain a fair hearing in the London *Times*, was the most disappointing. In one of his latest connections, however, the Jequie Rubber Syndicate, of which the annual report appears in our daily and *T.A.*, he appears to have veritably "struck oil!" We have noticed the boom in these shares on the Stock Exchange; the reason is now evident, if all the statements made are destined to be fulfilled. Mr. Boustead says they depend almost entirely on the statements of Mr. Frank, their manager with many years' experience of the country, and it was only on the general soundness of tho concern, of its agents, &c., that Mr. Bosanquet consented to become chairman. The company owns 80,000 acres, 540 of them being plantation (planted from from seed of trees giving 22 lb. rubber in one year and containing 325,000 trees, 3 to 5 years old.) Tho forests average 300 trees to the acre in 236 acros cleared—against 25 per acre in best African forests. The clearing of these cost under £1 por acre ; and, reckoning only 50 lb. rubber per acre, at a profit of 1s 6d per lb., they would have £3-15s return on £1 outlay As cost of production is estimated at 1s 6d per lb., this means the gross price is estimated at only 3s per lb.—while with additional machinery sent an average not far short of Eastern plantation was hoped for. Allowing for all contingencies it was reckoned by the manager that he could plant and bring tho land into bearing at £7 an acre! What have Eastern planters to say to *that*?

## RUBBER EXPLOITATION IN BRAZIL.

Following on substantial interim distributions, and a few weeks before the magnificent dividend declarations about to be made by the older rubber-producing Companies of the Middle-East, we do not envy Brazilian Company Chairmen their task of making the best, as Mr Ashmore Russan had to do the other day, of a balance sheet, which shows an even poorer result than a year ago, with no dividend, and only a prospect of floating a fresh subsidiary Company. This Company, it seems, is one of those which will do their part in allaying any fears that Brazil, whatever its increase in output, can possibly compete with Plantation Rubber in cheapness of production and net profits. We read of 8d. per lb. profit estimated, while 2s. to 3s. in the next year or two is not by any means an exaggerated estimate for profits on rubber from this side. Further efforts are to be made, it will be seen, to get the Brazilian Government to reduce the export duty, but the more popular official policy seems to be to grant a bonus on the proper planting of so many hundred thousand rubber trees, and, as Mr Russan says, all this means the expenditure of capital with a long wait for returns; while most Brazilian Companies are for the purpose of working concessions of rubber forests of a considerable age. While the South American Governments are, therefore, wise in their generation—as was that of the Congo till a few years ago, the attractions of Brazilian Companies with the home-investing public must remain at a discount, in competition with Ceylon, the Malay States and Dutch Indies.

## RUBBER INDUSTRY IN BRAZIL.

[From the 88-page South American Supplement.]

(London *Times* Rio Correspondent.)

Brazil occupies a commanding position in the world's markets by a product of the country—caoutchouc, or rubber. The wonderful progress in Brazilian rubber can best be gauged from the number of tons exported at intervals of ten years from 1827 to 1907. These are as follows:—1827, 31; 1837, 290; 1847, 625; 1857, 1,809; 1867, 5,827; 1877, 9,215; 1887, 13,390; 1897, 21,256; and 1907, 36,490.

Only six foreign nations import Brazilian rubber direct. Below are given the quantities and values for 1908 in metrical tons and sterling:

| | Tons. | £ |
|---|---|---|
| United States .. | 18,040 | 5,679,235 |
| Great Britain .. | 15,535 | 4,659,287 |
| France .. | 2,341 | 724,428 |
| Germany .. | 1,659 | 505,063 |
| Uruguay .. | 618 | 213,215 |
| Belgium .. | 13 | 3,409 |
| | 38,206 | 11,784,637 |

The figures for the first half-year of 1909 show a great improvement both in quantity and price—21,848 tons were exported, yielding £8,802,793.

While the supply of [wild.—Ed., *C.O.*] rubber from other countries appears to be on the decline, that of Brazil is constantly increasing. Very extensive regions are still untouched, and quite recently forests of maniçoba and mangabeira have been discovered. The plantation and culture of rubber plants has become very prosperous in many places.

The most important varieties of South American rubber are called by Brazilians "Seringa," or fine Pará, "Tapuru," "Caucho," "Mangabeira," and "Maniçoba," and are each derived from a totally different source, of which several qualities are generally prepared for market.

There are many other milk-yielding plants in Brazil, the most noteworthy being the gigantic Massaranduba tree, found in seven States of the Republic. The produce of coagulation of the latex is of great value in the rubber trade, and the timber is excellent for shipbuilding. The milk is very abundant, and possesses well defined medicinal qualites. This substance appears to be little known as yet, as only 139 kilogrammes were exported last year to France. In 1907 Great Britain took 175 kilos., but for 1906 and 1905 there was no shipment recorded. The omission is remarkable, because in 1903 and 1904 as much as 4,315 kilos, and 2,062 kilos, respectively, were shipped to the principal consuming markets.—London *Times*, Dec. 28.

## RUBBER PESTS IN KUDAT, BORNEO.

Of the 450 rubber stumps planted only 112 have as yet sprouted; some from the very root itself and some from the stumps. I found the white ant was playing havoc with the stumps, so instituted a crusade against them, with the result that we succeeded in finding 14 nests and destroying 14 queens; since then the rubber has been free of this pest, but I notice that there is a kind of beetle (bubok), which attacks the trees and bores into the stump even when green. I shall be glad to learn what action ought to be taken to combat this pest. The seeds sent from Tenom have been planted out but are not doing well, although perhaps it is rather early to make this remark.—W H Hastings, Resident, Kudat.

Tenom.—All the stations down on the list for being supplied with Para rubber seeds from the Experimental Gardens have received their first allottment. 200 stumps obtained from Sapong have been planted here and 100 supplied to each Kaningau and Tambunan. The deer are causing great havoc amongst the trees planted on the hill near the Residency. I am afraid it is useless planting unless one has a wire netting fence and some barbed wire.—E H Barraut, Resident.
—*B.N.B. Herald*, Dec. 16.

## A NEW CEYLON GREEN MANURE.

FOR TEA AND RUBBER.

The Superintendent of Telbedde, Badulla, Ceylon, advertises for sale *Boja Medelloa* seed. The name will probably be strange to most planters. It is a new seed to Ceylon. Mr Bamber saw it growing at Telbedde and was greatly taken with it. He strongly recommended it as a green manure for tea or rubber, especially the latter, and is now experimenting with it at Peradeniya. It will be a valuable addition to the available green manures of Ceylon. A prominent planting proprietor, who returned recently after an absence of some years from the island, asked what the most notable change was he noted in the Upcountry planting districts, declared it was the large extent to which green manuring had been adopted; and he added he had never seen the tea looking better. *Boja Medelloa* seems a very suitable plant for the purpose.

## IMPORTANT DISCOVERY IN SOIL FERTILISATION.

BY ROTHAMSTED SCIENTISTS.

It is doubtless pretty generally known among planters and the better educated of our other agriculturists here that the fertilising properties of soil consist largely in the amount of nitrogen made available. It may not be so well-known that the discovery of the fact that the formation of nitrates in the soil was made by two foreigners, Messrs Schloesing and Muntz. At any rate, if their names are not remembered, it was their discovery that first led men to look at the soil as the workshop of vast numbers of living organisms which prepare food for vegetable life. Even farmyard natural manure would be of no value—or do distinct injury—to crops, if it were not first broken up by soil bacteria into simpler compounds, finally reaching food that a plant can consume. The effectiveness of this action depends on the relative activities, subject to control by cultivation, of the various soil organisms. Another great discovery was in 1886 by Messrs Hellrigel and Wilfarth, who showed that certain bacilli, associated with nodules on the roots of leguminous plants, could fix nitrogen. Since then other bacteria have been found serving the same purpose without having to be associated with the leguminous plant. Gradually the knowledge of changes undergone by organic matter reaching the soil has been rendered more perfect, but without any new point of view emerging.

By the extra mail which reached Colombo on the 25th November, however, we received information of a fresh step made and a new factor that has to be taken into account. Nearly twenty-five years ago, it appears, an Alsatian wine-grower injected carbon bisulphide into his soil to destroy phylloxera, and was surprised to find that not only was the pest removed but the productivity of the soil increased. Little attention was attracted by this discovery, although recorded ; it was left as inexplicable. The experiments, however, being repeated within the last year, it was proved beyond the shadow of a doubt that increased productivity is secured by heating or treatment with volatile anti septics. A soil heated to water-boiling point for two hours will double the crop that it would bear without such treatment ; and additional benefit is secured for four successive crops. Treatment with carbon bisulphide, chloroform and toluene for two days, on the antiseptic being evaporated, increased the yield 20 to 40 per cent. in nearly all cases of soils and plants tried. The principle of these discoveries was illuminated by the work of Doctors Russell and Hutchinson of Rothamsted Laboratory who discovered the distinguishing feature of treated soils, namely, that they produced ammonia much faster from the nitrogenous reserves of the soil. Plants feed on ammonia and when they obtain the extra nitrogen, they can then get the requisite mineral food from the soil. On the bacteriological side the scientists verified that the heating wipes out the nitrification bacteria which form nitrates from ammonia; but most other species survive in greatly reduced numbers, including spore-producing organisms. The heating reduces the four to six million bacteria per gramme of soil to a few hundreds : treatment with antiseptics to between one and two millions. When the soil is remoistened, the surviving bacteria multiply at a rate never seen in untreated soil—up to 30 to 40 millions per gramme in ten days or a fortnight. These bacteria are makers of ammonia out of the nitrogenous organic matter, so their fertilisation value is evident. The Doctors named thus found that soil must contain a factor limiting the number of bacteria to allow the bacteria free play and that this factor must be put out of action. The factor was discovered to be organisms of the protozoa class, amœba, etc., which live on, and are a thousand times larger than, the ordinary bacteria. In the natural soil an equilibrium is preserved ; but heating kills them off entirely, and antiseptic treatment kills almost all. The productivity of soil, therefore, depends on the number of bacteria allowed to have free play, unhampered by larger organisms. Incidentally it is of interest to know that the scientist, Metchnikoff, from whose cure ex-Ceylon residents have recently derived so much benefit at home, holds that the white corpuscles of blood, much like amœba, keep us healthy by devouring intrusive bacteria. But the relation between the two powers in the human body has to be reversed in the case of the soil—for the maximum vitality and prolific value to be secured. When the discovery referred to becomes fully utilised in practice, it is impossible to estimate the vast increase in crops that will be obtained thereby. The thanks of agriculturists are due to Mr. J. F. Mason, M.P., whose generosity brought about the Bacteriological Laboratory at Rothamsted, and to the Goldsmiths' Co. for a recent endowment which brought Dr. Russell there to work. Meanwhile all planters who are keen on their profession and in the study of soil productivity should obtain from Messrs. A. M. & J. Ferguson, Colombo, the book by Mr. A. D. Hall, F.R.S., Director of the Rothamsted Station, on Fertilisers and Manures.

## ECONOMIC PRODUCTS FROM FIJI.

A number of mineral and vegetable products have been received recently at the Imperial Institute from Fiji for examination and valuation. Several products now reported on are the outcome of experiments. Some of these materials were exhibited at the Franco-British Exhibition last year; samples of all of them are now shown in the Fiji Court of the Imperial Institute.

### Cocoa.

Cocoas grown on two different estates were received :—

*A.* "Cocoa from Lami." The beans were rather variable in size, and some were shrivelled ; the husks were of dull brick-red colour due to "claying."

*B.* "Cocoa from Levuka." The beans were variable in size, and many were shrivelled. The husks were pale to reddish-brown in colour, and were not "clayed."

Commercial Valuation.—The cocoas were submitted to commercial experts for valuation with the following results :—

*Sample A.* One firm reported that this cocoa had a dark "break" and a poor flavour; they valued it at about 54s to 55s per cwt. in London (May, 1909).—A firm of manufacturers considered that this sample had been spoilt in preparation, being apparently too highly fermented. They described it as having a very dark break and a poor flavour, and valued it at 52s per cwt. (May, 1909).

*Sample B.* This cocoa was described as having a rather dull red, thin skin and a good palish break. It was valued at from 70s to 72s per cwt. in London (May 1909).—These valuations indicate that sample A is a distinctly inferior cocoa, and would realise low prices on the market, whereas sample B is of very good quality, and would fetch almost the same price as superior Trinidad, Caracas, or high-class Ceylon cocoa.

### Cassava Starch.

The material received consisted of clean white starch, free from visible impurity and without noticeable odour or taste. An analysis gave the following results :—Starch 84·8 per cent., Moisture 14·9 per cent., Ash 0·2 per cent. The product is, therefore, of high purity.

Commercial Valuation.—Cassava starch is not yet well known in this country, and the present specimen, was therefore submitted to experts in various branches of industry in which raw starch is used, in order to determine its utility and value as a substitute for the better-known starches in common use. The following information has been obtained regarding the suitability of the starch for various manufactures :—

Laundry Purposes.—The experts consulted on this point state that they have already tried cassava starch on several occasions for laundry work, and found that it did not compare well with the rice starch now in general use. A test made with the present sample from Fiji confirmed their opinion.

Glucose Manufacture.—Cassava starch is quite suitable for this purpose, but in this country it would have to compete with low-grade sago and tapioca flours and with maize. The former contain 60 to 70 per cent. of starch, and realised £5 to £6 per ton, so that clean cassava starch is not likely to be worth more than £8 per ton for the manufacture of glucose. If this Fiji cassava starch could be placed on the market at this price, a firm of glucose manufacturers offered to take a trial consignment of 50 to 100 tons.

Sizing Yarn.—As the result of comparative tests with cassava and potato starches as sizes for cotton yarns, it was stated that the former would not be a good substitute for potato starch, but it could probably be used in place of sago. The Fiji starch being of good colour and yielding a viscous paste with water, would probably be useful for dressing or finishing fabrics.

General Purposes.—A firm of brokers stated that there was at one time a good demand for cassava starch in Manchester and Liverpool at £14 to £15 per ton, and they were of opinion that this Fiji product would at present fetch about that price as a manufacturing starch if placed on the market in quantity.

### Ground-nuts.

The sample consisted of large ground-nuts, some of which contained two kernels and others only one. Those containing two varied in length from 1·2 to 1·8 inch, and those with one from 0·8 to 1·1 inch. The kernels were from 0·6 to 1·0 inch in length, and formed 75 per cent. of the total weight of the nuts. On extraction with solvents 49·1 per cent. of oil was obtained from the kernels. This represents a good average yield of oil, and compares well with that given by the ground-nuts of commerce. The sample was too small for satisfactory valuation, but it is probable that the kernels would fetch about the normal price for decorticated ground-nuts of good quality, viz. £14 to £15 per ton in London.

### Castor-Oil Seed.

Three varieties of these seeds were received :

1. "Fiji castor-oil beans, Mexican variety." These were small, dark-brown and mottled.

2. "Fiji castor-oil beans, Mexican variety." These were large white seeds, mottled with dark brown.

3. "Fiji castor-oil beans, Hawaiian variety." These were medium-sized dark brown mottled seeds, similar to No. 1, but larger.

The percentage of oil in each variety was determined with the following results :—Yield of oil No. 1 47·4 per cent., No. 2 49·6 per cent., No. 3 48·5 per cent. These percentages agree with the average figures recorded for castor-oil seed, which usually contains from 46 to 53 per cent. of oil. The slightly greater yield from the larger seeds (Nos. 2 and 3) is no doubt due to the fact that in these cases the proportion of kernel to husk is greater. Castor-oil seed as represented by these samples would probably realise from £9 to £9 10s. per ton in London.

### Fibres.

Ramie.—The samples consisted of four bundles of scraped ramie ribbons, which were labelled respectively, "*Boehmeria nivea*, grade I," "*Boehmeria nivea*, grade I," "*Boehmeria tenacissima*, grade I," and "*Boehmeria tenacissima*, grade II." There were also two bundles of degummed fibre labelled "Ramie fibre, *B nivea*" and "Ramie fibre, *tenacissima*." Each sample weighed about 2 ounces. The specimens were all clean and well prepared, but those marked "Grade II" were somewhat inferior in these respects to those marked "Grade I." Compared with ramie fibre from Fiji previously examined at the Imperial Institute the present samples were longer, varying generally from 4 feet to 5 feet, and the ribbons were much broader, being half-an-inch or more in breadth, whereas previous samples consisted of very narrow ribbons. Although somewhat different in appearance from both hand-scraped China grass and ramie ribbons from Fiji previously examined, the present samples were nevertheless of good quality, and would probably approximate in value to hand-scraped China grass, which was quoted in London at £21 to £27 per ton in December, 1908.

ALOE FIBRE.—The sample weighed 7 ounces and consisted of light buff-coloured fibre, of excellent lustre, perfectly cleaned and prepared, and of very good length (about eight feet). It was quite similar to Mauritius hemp from Fiji previously examined at the Imperial Institute, but was longer and a little coarser. The latter characteristic was probably due to the greater age of the leaves from which the fibre was prepared. The fibre was valued at about £31 per ton, as compared with good average Mauritius hemp at £22 10s. per ton.—*Bulletin of the Imperial Institute*, No. 3 of 1909.

## COCOA IN THE GOLD COAST.

The rapidity with which the cultivation of cocoa has extended is most gratifying, and also indicative of its suitability for this Colony. The natives have taken kindly to the industry; plantations are being extended, and we may safely anticipate an increasing export for some years to come. A glance at the table of exports (appendix I.) shows the marvellous rapidity with which the industry has developed. If we go back to 1895, we find the amount of cocoa exported was only 28,906 lb. valued at £471. The introduction of cocoa to the Gold Coast only dates back to about 1882 and after 26 years' cultivation the export of the product has attained a total of 28,545,910 lb. in 1908. In studying these figures one must not forget that this has been entirely produced by native farmers, and I consider that the results so far attained are highly creditable to the enterprise and industry of the indigenous population. The quality of the product, in comparison with that of most other cocoa-producing countries, is generally speaking poor. There are several causes contributing to this: (*a*.) It is an industry new to the natives, and consequently they have not yet been educated in the proper methods of cultivation and preparation: (*b*) The variety of tree grown (Forastero, amelonado variety) is generally recognised to bear a second grade quality of beans even when grown under the most favourable conditions: (*c*) The natives are entirely dependent on the sun for drying the beans, and in a country like this where the atmosphere is very humid, mould forms on the beans very readily in dull weather: (*d*) All qualities (with the exception of the very worst) have hitherto been brought at a uniform price.

The Agricultural Department is naturally concerned with the improvement of the quality of cocoa. Travelling Instructors have already done a lot of good work, lecturing and giving practical demonstrations on the plantations; but, owing to the shortage of competent officers, by no means all that could be wished has been effected. The variety grown, although recognised as yielding only a second grade quality of cocoa, is hardy and very fruitful and therefore, in my opinion, well suited for native cultivation. A few plants of three other varieties have been introduced by the Agricultural Department, but the results so far obtained have not been such as would recommend their more extensive cultivation to the exclusion of that at present grown. I hope, however, to put down experimental areas of the more important varieties at each of the Agricultural stations so that this point may be settled.

That cocoa can be made to yield well in the Colony is amply illustrated by the fact that on the Aburi Botanic Gardens from a small area of 1·40 acres and from 259 trees planted at 15 x 15 feet, a yield of 18,200 pods equivalent to 15 cwts. of cured cocoa was procured between the 23rd October and 31st December of this year.

The quality of the soil on which these trees are growing is distinctly below the average of the Colony; but the trees have been well pruned and attended to, and this may be taken to represent a maximum yield. It is doubtful if such results will often be exceeded in any cocoa growing country. Further, I am informed that a considerable crop was taken in the earlier part of this year of which no record was kept; and the trees are now giving promise of an early crop in 1909.

The fermentation and drying of the beans is at present receiving much attention, but amongst a primitive people and with a new cultivation, progress is naturally slow; some, however, show an intelligent interest in bettering the quality and it is hoped that a considerable improvement will be effected within the the next few years. The fact that the merchants paid a uniform rate, irrespective of quality, did much to militate against such improvement. Parcels of better quality were no doubt somewhat scarce, and the difficulties experienced in forming uniform grades of higher quality probably prompted the merchants to buy on a uniform principle; but as cultivation extends quality improves, and transport facilities are extended I have no doubt the merchants will adopt the more satisfactory method of payment for quality. This would no doubt tend towards improvement more quickly than anything else, provided, of course, that the producer reaps some benefit; for in many cases middlemen, or brokers come between the merchants and the native farmers. The greatest deterrent, in my opinion, however, is transport, and I feel sure that if this industry is to prosper greater facilities must be provided. Roads and railways are no doubt costly, but now that the success of so important and extensive an industry is assured, it seems almost certain that they could be made to pay, and would set free much labour now engaged in carrying head loads, which could be employed in the further development and improvement of the industry.—Official Report on 1908 by W S TUDHOPE, Director of Agriculture.

## "MIMOSA PUDICA" IN COORG.

It has been found necessary by the Coorg Administration to draw the attention of all land-owners and officials to the very rapid spread taking place in parts of the Province of "a creeping, thorny weed believed to be *Mimosa pudica*," said to have been imported into the Province from Malabar. Measures for its extermination are recommended, otherwise it is feared that grazing grounds and other lands may be ruined by the further spread of the weed.—*M. Mail*, Oct. 20.

## THE INDIA RUBBER MARKET, 1909.

### S. FIGGIS & CO.'S ANNUAL REVIEW.

PLANTATION RUBBER GROWN IN CEYLON AND BRITISH MALAYA.

(Federated States, Perak, Malacca, Johore, Straits), Sumatra, Java, India, &c. :—

| | 1909. tons | 1908. tons | 1907. tons | 1906. tons | 1905. tons |
|---|---|---|---|---|---|
| Exported from Ceylon (& India) | 600 | 350 | 230 | 160 | 70 |
| Malaya, &c. | 3000 | 1450 | 780 | 350 | 75 |
| Tons. | 3600 | 1800 | 1010 | 510 | 145 |

We estimate about 600,000 acres are now under Rubber cultivation in the East (partly mixed with other products), and 120,000 acres in Mexico, West Indies and Nicaragua, &c.

The improvement in quality we noticed in our last annual review, has continued, and we congratulate planters on the large proportion of clean Crêpe of nice colour, and the very small quantity of "tacky" rubber. This shews how profitable it has been for planters to

WASH AND CLEAN THE RUBBER THOROUGHLY,

and to prepare as large a proportion as possible of good colour—*also not to send many qualities or very small lots.* Block has not been in favour: unless clean resilient hard quality can be sent, it may be better to ship as Crêpe or sheet.

PACK IT IN GOOD DRY CONDITION

(excess of resin much objected to) into strong cases of 2 cwt. to 3 cwt. each. No paper, fuller's earth, &c., to be used. The cases should be planed smooth inside to avoid small pieces of wood adhering to the Rubber.

Keep *different qualities and colours separate; where practicable keep immature separate*; send separately dirty barky pieces, and *wash out all the bark* in Crêpe, Block and Sheet. All fine qualities should be loose Crêpe, Sheetor Biscuit —not run to a mass.

Last January good sheet realised 5s. 1¼d to 5s. 3d, pale Crêpe 5s. 4½d. By May 5s. 9d to 5s. 10d, June 6s. 7d, July 8s. 2d to 8s. 3½d, August (irregular) 7s. 10d to 7s. 3d, and up in September-October to 9s. 1½d, and smoked 9s. 8½d early November, the highest of the year. With larger supplies of Para in December prices declined 2s., to 6s. 11½d to 7s. 1½d Sheet and Crêpe, but since recovered: sheet to 7s. 3d to 7s. 5d fine Crêpe 7s 6½d, smoked Sheet 8s 0¼d to 8s 0¾d; these are the closing prices. Good supplies landing for auctions 4th January.

Now that the quantities are increasing so rapidly, it is most desirable for the future ready sale of Plantation Rubbers, for estates to "standardise" the qualities they produce, and where practicable to ship say three qualities from an estate, No. 1 pale, No. 2 light brown and grey, No. 3 dark and brown. Pickings and very common and scrap to be sent in one bulk for sale on arrival; "standardised" qualities can be sold for forward deliveries, the same as Para has been sold for many years. Plantation must be largely sold "forward" in future years.

The unlooked for extravagant and unprecedented high prices obtained from July to October were due to the great extension of "motors," cars, cabs, &c., particularly in America, where enormous contracts for "tyres" created an increased consumption of Rubber. At present this goes on, but the speculative deals, which left so many "Bears" to be covored (at a loss), are reduced.

Planters should be amply satisfied with anything near the present rates, which are 2s 5d per lb. above last January. The highest price 1909 was paid in November, 9s 8½d for fine smoked sheet.

SMOKED RUBBER

appears to have greater resiliency and to be more suitable for many purposes than unsmoked. "Smoking" prevents the "proteins" in rubber from decomposition, and generally prevents "tackiness." All fine rubber from Para is smoked. During the excitement well-smoked sheet realised 6d per lb. above good unsmoked. Of course such a great difference will not be obtainable when the proportion of smoked is larger.

We hear of complaints of injury to the trees by Formes and white ants—these must be carefully watched by experts on the estates.

The Brazil supply has increased, both from the Amazonas and Maniçoba, Mangabeira, &c.

The production of reclaimed and common substitutes for rubber has increased, but thero is no "Synthetic."

We have had some fine lots of Rambong in nice condition, principally from Sumatra, and it realised high prices. Castilloa was indifferent quality.

THE WORLD'S SUPPLY IN 1909

was about 69,000 tons against 65,000 tons in 1908, and 69,000 tons in 1907. Consumption we estimate was about 68,000 tons.

Of Rubber planted we estimate in the East nearly 600,000 acres—

| | 1909 | 1908 | 1907 |
|---|---|---|---|
| CEYLON .. | 187,000 acres | 180,000 | 150,000 |
| MALAYA, MALACCA, &c. ... (containing about 21 million trees, not three million tapped in 1909) | 240,000 do | 185,000 | 100,000 |
| BORNEO ... | 10,000 do | 10,000 | 9,000 |
| DUTCH EAST INDIES {70,000 Java} {Sumatra 50,000} &c, | 120,000 do | 90,000 | 70,000 |
| INDIA and BURMAH ... | 31,000 do | 30,000 | |
| GERMAN COLONIES, NEW GUINEA, SAMOA, W. & C. AFRICA, &c. | 38,000 do | | |

MEXICO, NICARAGUA and HONDURAS have plantations, but are not yielding much, and mostly Castilloa:—probably by now 120,000 acres planted; also COLOMBIA, ECUADOR, BOLIVIA and PERU.

INDIA is extending slowly. Some in BURMAH and MERGUI: the PHILIPPINES (small as yet), SAMOA, HAWAII, in NEW GUINEA and other Islands, QUEENSLAND and SEYCHELLES. The WEST COAST of AFRICA has plantations; some in the CONGO region and GERMAN WEST AFRICA, also in BRITISH EAST AFRICA, UGANDA, and the WEST INDIES probably 5,000 acres.

BRAZIL and BOLIVIA exported in 1909 42,000 tons, 40,000 tons in 1908, 41,500 tons in 1907, MANICOBA increased largely, also GUAYULE

from Mexico, largely used in America and Continent. Probably 3,500 tons.

From Brazil, Amazonas, Bolivian Peruvian and (Wild) Medium Rubber.

The great variations in value recorded in our last Annual (1908) are "not in it," compared to the extraordinary rise to 9s 2d (curiously a reverse of figures, 2s 9d, was the lowest price in 1908) for fine Hard on the 30th September and the many rapid ups and downs in prices. Many transactions at the highest were simply 'Bears' driven into a corner and compelled to buy, and sales at the same moment at 1s or 1s 6d per lb. less were made for forward deliveries. It is impossible to recapitulate the vagaries of price and we may not soon again see such violent fluctuations. Compared with last January today's prices shew an advance on Fine of 2s 5d, Negrohead 9d to 10d, on Ball Caucho only 6d. Soft fine has shewn a far greater difference in value to Hard than ever before. Last January we had sales of Fine Hard at 5s 2d and forward at 5s 0½d, Soft at 4s 10½d, Negrohead, scrappy at 3s 8½d, Cameta 2s 8d, Island 2s 6d, Ball 3s 6½d. A fair trade continued at about these values with an upward tendency and in June 6s 3d was paid for Hard, 4s 1d for Ball. We had a rapid rise in July—at the close 8s 3½d for Hard but 6d less in August, and forward sales were then made at 6s to 6s 6d, and Ball up to 4s 6d. September and October were months of great activity and excitement, mainly by America buying largely and Bears being caught. Hard was sold at the highest price for 1909, at 9s 2d, Ball up to 5s 1d. We had a quick fall in November with larger receipts, but some recovery towards end of December with smaller receipts and close steady. Fine Hard 7s. 7d, forward 1d to 1½d less, Soft 7s. 0½d, Negrohead Scrappy 4s. 7½d, Cameta 3s. 4d, Island 3s. 1d, Caucho Ball 4s. 1½d. The imports of medium Rubbers have not been excessive, their value did not increase seriously.

Trade has been good in England and France, middling in Germany and Russia, but unprecedentedly large in America.

The world's supply of about 69,000 tons has been mostly consumed. In 1908 we had 65,000 tons, and 1907, 69,000 tons, 1906, 65,000 tons.

"Slab" Rubber was scarce and sold well, "Ball" plentiful (and of good quality) and very ready sale. "Tails" improved and sold better. West Coast African increased.

W.C.A.—15,500 tons against 14,000 tons in 1908, 17,000 tons in 1907, and 17,200 tons in 1906.

Visible Supply, 1st January, 1910.

| | 1910 tons. | 1909 tons. | 1908 tons. | 1907 tons. | 1906 tons. | 1905 tons. |
|---|---|---|---|---|---|---|
| Of Para and Peruvian | 3,278 | 3,188 | 3,722 | 2,162 | 2,874 | 2,666 |
| Including America | 1,250 | 1,305 | 1,210 | 1,160 | 1,600 | 1,830 |
| 1909 Brazil and Bolivia (from the Amazonas) | | 39,050 | 38,160 | 37,520 | 34,520 | 31,420 |
| Including Peruvian and Caucho *via* Iquitos and Manaos | | 8,250 | 7,460 | 7,160 | 6,250 | 6,100 |

We had very little Slab, but increased supplies of Ball of nice quality. Putumayo Tails improved in quality, consequently sold more readily.

This year's crop was very good quality. All fine *should be cut and carefully selected before shipment.* Caucho Ball increased and was of useful quality. Bolivia increased. Mollendo moderate. Venezuela *via* Orinoco more. Ceara and Manigoba great increase. Pernambuco and Assare small supply. Mattogrosso crop was fair but quality not very good. Mangabeira, from Santos and Bahia, less supply.

Central America.—Supply moderate. Mexico increased supply. Colombia small lots, and part poor undesirable quality. Ecuador was fair quality, also Nicaragua. We had a few lots of Plantation from these countries, and estimate 120,000 acres planted there.

| | 1909. tons. | 1908. tons. | 1907. tons. | 1906. tons. | 1905. tons. |
|---|---|---|---|---|---|
| West Coast African (total about) | 15,500 | 14,000 | 17,000 | 17,200 | 17,500 |
| including Benguela and Mossamedes | 1,920 | 1,690 | 1,700 | 1,450 | 1,650 |
| Loanda | 950 | 700 | 900 | 700 | 800 |
| Congo & French Congo | 6,300 | 5,900 | 6,000 | 5,900 | 5,550 |

Qualities have somewhat improved, and prices were better for Niger, Gold Coast, Accra and Lagos. Good qualities from the Cameroons, Sierra Leone, Gaboon and Conakry sold at high prices.

The French Congo & Soudan, mostly from Sénégal *via* Bordeaux, sold well.

About 1,850 tons, against 1,050 tons 1908, 1,200 tons 1907, 1,300 tons 1906, 1,250 tons 1905.

Liverpool imports W & C African 2.900 tons, against 2,580 tons 1908, 3,740 tons 1907, 4770 tons 1906.

Antwerp imports, mostly Congo, 5,300 tons, against 4,900 tons 1908, 5,000 tons 1907.

East Coast African.—Zanzibar, &c, more; prices show and advance for the year of about 9d per lb.; quality has been fair. Nyassaland very little. Mombassa and Lamu fair. Uganda larger; some nice clean Plantation. Abyssinian in larger supply and quality fair.

Madagascar—Still small supply; prices close showing a rise of 9d to 1s. Niggers—Some lots nice clean sold well. Rangoon small. Assam small and high. Penang greatly increased and sold readily. Supply of Java was small, but planting is going on freely, and we may expect increased supplies. Borneo more and sold well. Tonkin and French Cochin China fair but sold well. New Guinea sent us none. Pontianak has been abundant and fairly high.

Balata in fair supply, and higher; Sheet 2s 3d up to 2s 8d, Block 1s 7½d up to 2s 2½d, closing at 2s 8d and 2s 2d. Gutta Percha of slow sale till the close of the year, when demand increased.—S. Figgis & Co., India Rubber and Colonial Brokers.

India Rubber Statistics for 1909.

Total Imports, &c., of all sorts were:—

England.

| | Imports. | Deliveries. | Stock 31st Dec. |
|---|---|---|---|
| 1909 | 24563 | 24225 | 1848 tons |
| 1908 | 21611 | 23369 | 1510 ,, |
| 1907 | 22964 | 21317 | 3268 ,, |
| 1906 | 21269 | 21162 | 1669 , |
| 1905 | 21700 | 21410 | 1562 ,, |

London.

| | Imports. | Deliveries. | Stock 31st Dec. |
|---|---|---|---|
| 1909 | 5433 | 5207 | 604 tons |
| 1908 | 2983 | 3608 | 378 ,, |
| 1907 | 3509 | 3149 | 1003 ,, |
| 1906 | 2604 | 2444 | 691 ,, |
| 1905 | 2126 | 2003 | 531 ,, |

| | Imports. Para, Manaos. | Imports. Peru, Caucho. | Deliveries. Para, Manaos. | Deliveries. Peru, Caucho. | Stocks, 31, Dec. Para, Manaos. | Stocks, 31, Dec. Peru, Caucho & Tails. |
|---|---|---|---|---|---|---|
| 1909 | 10179 | 4630 | 10066 | 4588 | 388 | 390 |
| 1908 | 11006 | 4310 | 11654 | 4461 | 275 | 348 |
| 1907 | 9828 | 3882 | 9282 | 3408 | 923 | 499 |
| 1906 | 8728 | 3435 | 8924 | 3471 | 377 | 25 |
| 1905 | 10156 | 3328 | 9760 | 3336 | 573 | 61 |

Prices, 31st December.

| | Hard Fine Para. | Negrohead Scrappy. | Negrohead Island. | Caucho Ball. |
|---|---|---|---|---|
| 1909 | 7/7 | 4/7 | 3/1 | 4/1½ |
| 1908 | 5/1½ | 3/9½ | 2/6 | 3/7 |
| 1907 | 3/5 | 2/10 | 2/0½ | 2/9 |
| 1906 | 5/2½ | 4/0¾ | 3/ | 4/3 |
| 1905 | 5/5 | 4/ | 3/3½ | 3/10¼ |

| | 1909. | 1908. | 1907. |
|---|---|---|---|
| Imports of Rubber besides (Brazil) Para and Peruvian to England | 9754 | 6295 | 9254 |
| Deliveries (Brazil) Para and Peruvian to England | 9571 | 254 | 8627 |
| Stock 31st December (Brazil) Para and Peruvian to England | 1070 | 887 | 1846 |

| | 1906. | 1905 |
|---|---|---|
| Imports of Rubber besides (Brazil) Para and Peruvian to England | 9106 | 8216 |
| Deliveries (Brazil) Para and Peruvian to England | 8767 | 8314 |
| Stock 31st December (Brazil) Para and Peruvian to England | 1267 | 928 |

| 1909. | Plantation Cey.&Malay | Rangoon, Assam, &c. | Penang. | Borneo. | Zanzibar & Moza'bique. | Madagascar. |
|---|---|---|---|---|---|---|
| Imports | 3607 | 46 | 474 | 135 | 345 | 48 |
| Deliveries | 3396 | 41 | 470 | 139 | 331 | 54 |
| Stock 31st Dec. | 360 | 9 | 53 | 30 | 59 | 8 |
| Imports 1908 | 1668 | 87 | 151 | 67 | 279 | 88 |
| do 1907 | 1132 | 199 | 334 | 304 | 298 | 428 |

| 1909. | W. Indian & S. American. | Mattogrosso. | Manicoba, Ceara P'nam, Assare &c. | W. C. African. | Mollendo. |
|---|---|---|---|---|---|
| Imports | 444 | 226 | 1278 | 2997 | 139 |
| Deliveries | 433 | 237 | 1260 | 3048 | 147 |
| Stock 31s, Dec. | 56 | 3 | 151 | 341 | *Nil* |
| Imports 1908 | 341 | 212 | 603 | 2633 | 149 |
| do 1907 | 473 | 130 | 1556 | 4109 | 127 |

PARA MONTHLY STATISTICS, 1909.
(Including Peruvian and Bolivian.)
Shipments (January to December,)

| 1909. | Receipts at Para. Para. | Receipts at Para. Peruvian. | Shipments to Europe. | Shipments to America. |
|---|---|---|---|---|
| January | 4300 | 1190 | 2830 | 2210 |
| February | 3800 | 1240 | 2070 | 2470 |
| March | 2910 | 1230 | 2480 | 1970 |
| April | 2360 | 1400 | 2340 | 1910 |
| May | 1480 | 860 | 1540 | 1160 |
| June | 1100 | 470 | 960 | 920 |
| July | 1060 | 340 | 700 | 720 |
| August | 1610 | 260 | 1110 | 220 |
| September | 1780 | 240 | 1080 | 1200 |
| October | 2950 | 320 | 1560 | 2090 |
| November | 4250 | 390 | 1790 | 1670 |
| December | 3200 | 310 | 1350 | 2940 |
| | 30800 | 8250 | 19810 tns | 19480 tns |
| (Shipping weight) against in 1908 | 30700 | 7460 | 20630 tns | 17530 tns |
| 1907 | 30360 | 7160 | 20940 | 16460 |
| 1906 | 28270 | 6250 | 18440 | 16270 |
| 1905 | 28320 | 6100 | 18520 | 15260 |

England (Landing Weights.)

| 1909. | Imports. | Deliveries. | Stock end of month. |
|---|---|---|---|
| January | 1108 | 1033 | 698 |
| February | 1149 | 1426 | 7[illegible]1 |
| March | 1627 | 1310 | 1038 |
| April | 1[illegible]21 | 1449 | 1210 |
| May | 1697 | 1708 | 1199 |
| June | 1102 | 1189 | 1112 |
| July | 869 | 801 | 1180 |
| August | 896 | 843 | 1233 |
| September | 1014 | 1218 | 1029 |
| October | 892 | 1233 | 688 |
| November | 1425 | 1156 | 957 |
| December | 1109 | 1288 | 778 |
| | 14809 tons | 14654 tons | net |
| (Shipping weight) against in 1908 | 15316 tons | 16115 tons | |
| 1907 | 13710 | 12690 | |
| 1906 | 12263 | 12395 | |
| 1905 | 13484 | 13096 | |

| | | Imports. | Deliveries. | Stock 31st Dec. |
|---|---|---|---|---|
| American (Para & Peruvian) | 1909 ... | 19580 | 19815 | 150 |
| | 1908 ... | 18310 | 18195 | 385 |

CROP STATISTICS from 1st July to 30th June each year.

| | 1908/9. | 1907/8. | 1906/7, | 1905/6. | 1904/5 |
|---|---|---|---|---|---|
| Para Receipts: | | | | | |
| Para & Manaos | 30010 | 29180 | 31180 | 28340 | 27390 |
| Peruvian and Caucho | 8080 | 7470 | 6820 | 6150 | 5650 |
| Para Shipment to Europe: | | | | | |
| Para & Manaos | 13570 | 16010 | 14170 | 16350 | 12160 |
| Peruvian | 5630 | 5730 | 5130 | 4775 | 4050 |
| Para Shipments to America: | | | | | |
| Para and Manaos | 16560 | 12990 | 17040 | 12925 | 15220 |
| Peruvian | 2490 | 1680 | 1690 | 1370 | 1595 |

CROP STATISTICS.
June to 31st December.

| | 1909. | 1908. | 1907. |
|---|---|---|---|
| Para Receipts ... | 16710* | 15750† | 14240 |
| ,, Shipments Europe ... | 7590‡ | 6980 | 8190 |
| America ... | 8840§ | 8410 | 5550 |
| England Landings net ... | 6205 | 5328 | 5741 |
| ,, Deliveries net ... | 6539 | 7160 | 5858 |
| America Landings net ... | 8240 | 9220 | 5470 |
| ,, Deliveries net ... | 8880 | 9345 | 5770 |
| Continental Imports net ... | 1030 | 1210 | 1805 |
| ,, Deliveries net ... | 1020 | 1410 | 1765 |

| | 1906. | 1905 |
|---|---|---|
| Para Receipts ... | 14720 | 14690 |
| ,, Shipments Europe ... | 6630 | 8324 |
| America .. | 7820 | 5845 |
| England Landings net ... | 4664 | 6037 |
| ,, Deliveries net .. | 5487 | 6149 |
| America Landings net ... | 7870 | 5330 |
| ,, Deliveries net .. | 8230 | 5880 |
| Continental Imports net ... | 1520 | 1930 |
| ,, Deliveries net ... | 2010 | 2000 |

S. FIGGIS & Co., Rubber Brokers, London, 3rd January, 1910.

## JAVA LABOUR FOR COCHIN-CHINA RUBBER ESTATES.

Recruiting of Javanese labourers for planting work in Cochin-China has begun in Java, permission to that end having just been secured from Government. The first batch will be 125 strong and will be engaged for labour on a rubber estate at Phu-quoc.—*Straits Times*, Dec. 7.

* 1909—Para 14850 and Caucho 1860.
† 1908—Para 14060 and Caucho 1690.
‡ Para 6280 and Caucho 1310.
§ Para 8300 and Caucho 540

## THE RUBBER MARKET DURING 1909.

(*Wilson, Smithett & Co.'s Report.*)

London, Jan. 5.—The year under review has been remarkable for the very high prices prevailing, during the last six months, the value of Para rising from 5s. 1½d. in January to 6s. 4d. at the beginning of July, and from that point to 9s. 2d. in September, with but few reactions, thus exceeding by a long way all previous records, which had hitherto stood at 5s. 9¼d. per lb. The later autumn months saw a considerable decline for spot and near delivery, it being impossible to maintain the famine prices, due to the urgent trade demand at a time when supplies were at the lowest level of the year, and when, owing to the unusually low state of the Amazon, receipts at Para were small and greatly delayed in the interior; the forward positions, however, to a great extent held the rise, as while spot was at the highest point, February-March, 1910, delivery, was sold at 7s. 9d. per lb., whereas at the close of the year the comparative values were 7s. 7½d. and 7s. 5½d. per lb. The receipts in Para during the first half of the year were slightly below those of a year ago, but the latter half has proved a period of larger receipts, doubtless to some extent due to enhanced values, and the efforts made to participate in the profits.

### Eastern Plantation

has, as anticipated, rapidly increased in quantity, but we cannot yet give the final returns for the year. The extraordinary movements in the price of Para noted above have been fully reflected in this market, both upwards and downwards, but it has been difficult to maintain the premium hitherto paid; this fact, however, is more than counterbalanced by the greater freedom of sale thereby induced; by the extremely satisfactory way in which the fortnightly offerings havo boen takon by consumers. At the opening auctions good to fine biscuits and sheet sold at 5s 1d to 5s 8d, with palish to fine pale crepe commanding similar prices, and values appreciated, with but few checks, until 24th September, when the prices recorded wero 8s 11¼d to 9s 1½d for good biscuits and sheet, 9s 7d for smoked sheet, and 8s 8¼d to 9s 1¾d for good to fine crepe. After some slight reaction, on 4th November good biscuits and sheet realised 9s 0½d to 9s 3½d, good to fine smoked sheet 9s 4d to 9s 8½d, and good to fine crepe 8s 11¼d to 9s 3½d per lb. The record price of 9s 8½d per lb. was thus established. From this time until 14th December values tended downwards, and on the latter date good biscuits and sheet sold at 6s 11½d to 7s 1d, good to fine smoked sheet at 7s 3d to 7s 7½d, and good crepe at 6s 11½d to 7s 1½d per lb.; the closing auctions, however, showed some recovery to 7s 2d to 7s 4¾d, 7s 10d to 8s 0¾, and 7s 5d to 7s 6½d per lb. respectively.

The high standard of quality established by growers from the beginning has been well maintained, but the extreme prices have occasionally induced some rather premature tapping, resulting in a small proportion of weak and immature sheet been placed on the market. Trade interest in Plantation kinds is expanding most satisfactorily, and the increased supplies have been fully absorbed. A year ago we expressed a doubt whether paleness in colour would continue to attract a premium, and excepting in Crepe this has been borne out with but few exceptions. Biscuits, excepting on the smaller producing estates, have been mainly supplanted by Sheets, unless the first quality latex is turned into Crepe. A considerable improvement has been made in the manufacture of the lower grades, which have commanded relatively high prices throughout the year. Block continues to arrive regularly from one important estate, but other supplies are very limited and this form of preparation is not recommended for general adoption.

### Rambong,

owing to its gradual eradication on many Plantations in Malaya, has latterly been in smaller supply, but some desirable consignments of useful character have been received from the Dutch Possessions.

### Smoked Sheet

during the latter part of the year has, as noted above, commanded a substantial premium, some manufacturers preferring it to unsmoked, It is, however, doubtful what difference, if any, will be seen in the value when supplies become larger, but the process appears to harden the rubber and at the same time tends to avoid mouldiness and tackiness.

### Packing.

This question has received more attention during the latter part of the year, and we would again point out the necessity of having an absolutely smooth interior to the cases; otherwise splinters of wood are liable to become drivon in to the Rubber, and manufacturers experience great difficulty in extracting the pieces. No papor or other lining should be introduced.

### Statistics.

| | 1909 tons | 1908 tons | 1907 tons | 1906 tons | 1905 tons |
|---|---|---|---|---|---|
| Para Receipts, Jan.-June... | 22390 | 22425 | 23435 | 19800 | 19720 |
| Do do July-Dec,... | 16650 | 15765 | 14230 | 14680 | 14690 |
| Total ... | 39040 | 38190 | 37665 | 34480 | 34410 |
| Comparative value of Para 31st December ... | 7/7½ | 5/1½ | 3/5 | 5/2¾ | 5/5 |
| Stock of all growths in London .. | 600 | 373 | 1017 | 739 | 590 |
| Do Plantation do .. | 353 | 147 | 157 | 66 | — |
| Total Imports, London, twelve months... | 5392 | 3021 | 3674 | 2734 | 2269 |
| Total Deliveries do .. | 5158 | 3674 | 3238 | 2570 | 2140 |
| Plantation Imports do ... | 3550 | 1642 | 1125 | 439 | — |
| Do Deliveries do .. | 3342 | 1667 | 1016 | 396 | — |
| Ceylon shipments, 1st Jan, to 14th Dec. | 567 | 343 | 224 | 136 | 162 |
| Singapore shipments, 1st Jan. to 30th Nov. .. | 994 | 829 | 566 | 277 | — |
| Penang shipments, 1st Jan, to 15th Nov. .. | 862 | 575 | 206 | 37 | — |
| Port Swettenham 1st Jan. to 31st Oct. .. | 954 | — | — | — | — |
| Total (British Possessions and Protectorates).. | 3377 | 1747 | 996 | 450 | — |
| Stock all growths Liverpool 31st Dec.... | 1244 | 1132 | 2265 | 960 | 1029 |
| Do Para do do ... | 388 | 275 | 921 | 370 | 573 |

## MESSRS LEWIS AND PEAT'S REPORT.

### World's Production 75,000 Tons against 70,000 Tons in 1908.

### Plantation 4,600 ; against 2,200 Tons in 1908

London, 1st Jan.—The year 1909 has been a phenomenal one for Rubber and at times the variations in values extraordinary. Prices for Fine Para have fluctuated from 5s 2¼d at the lowest to 9s 3½d at the highest, or roughly speaking 4s per lb a variation hitherto unknown in the article. The previous record highest price was 5s 9d per lb in 1905. The average price for five years, including 1909, works out at 5s 4d per lb and for the last ten years at 4s 6d per lb. Plantation Para has fluctuated in price from 5s 1½d in January to 9s 8½d in November, and closes at 7s 6d for Biscuits and Sheets against 7s 6½d for Fine Para on the spot and 7s 5d for forward delivery.

The Brazilian Crop, commencing last July, will doubtless prove a large one, although supplies have up to now been somewhat hindered by the low waters of the Upper Amazon, but this only means that they will arrive later than was expected, and it is probable the heavy weight of the Crop will be felt in January-March. The Americans have up till now taken the bulk of the supplies received in Manaos and Para, so that only just sufficient supply has reached Europe for European Trade requirements, and yet prices have dropped from 9s 3½d in October to 7s 6d in December, as soon as the squeeze was over. All interested in either Fine Para or Plantation Rubber, when considering the likely course of prices during 1910, should bear in mind that 1910 commences with a range of prices 2s 4d per lb. above the prices ruling in January, 1909 and whilst it is true the demand for the past six or eight months has been extraordinary and very little affected by the enormous and abnormal prices consumers have had to pay, it is not reasonable to expect such rates will be maintained when the heavy supplies come to hand as come they must. Possibly early in the year there will be a decline of 6d or 9d per lb followed by a recovery, as consumers fill their require ments; but we do not look for a low range of prices for some time to come. We should rather venture a prediction of a 7d basis with variations of 3d per lb or possibly 6d either side of 7d for the next six months, both for Para and Plantation. Such a position and basis must be considered a most satisfactory one for Planters and Producers, and equally so to those who have taken an interest in Rubber Companies as an investment.

We do not hesitate to call attention to the benefits being derived, and to be derived, in London and in the Rubber World generally from the enterprise, capacity and intelligence of Planters in the East, which has brought about this great, lucrative and important industry, to their own advantage and that of everyone connected with it. An enormous amount of capital has been invested in Rubber Companies, but it must be borne in mind that such an industry requires, and is entitled to, a huge capital, and we are of opinion that the outlook is a bright one for Rubber Producers and Investors from the simple fact that the demand is a growing one, and that Consumers and Manufacturers are finding by experience that in buying Plantation-Grown Rubber they are receiving in their factories an article of high merit and purity to be relied upon and free from the irregularity and uncertainty of native-prepared and wild rubbers. The result is certain. The demand for cultivated rubber must and will increase, and we do not believe, with all the new enterprises entered into, that it has been overdone, although we do not for one moment expect the present enormous profits are going to last, although for some time to come we are persuaded that there is no industry with such prospects as present themselves in connection with the plantation rubber industry.

POINTS :

During the past year features of plantation rubber may be summarised as follows :—

General improvement and regularity of quality and colour of crêpe, which facilitates business and the execution of manufacturers' orders.

The special demand and top price paid for Smoked Sheet, the smoking process having apparently increased or preserved the strength of the rubber, and saved it from deterioration by heat or microbe action, &c., exampled by "Highlands and Lowlands" and "Vallambrosa."

The extraordinary demand and relative increase in prices paid for clean brown crêpe and good crêpe scrap.

The maintained excellence and evenness of the Premier "Lanadron" Block.

The lead for colour and quality by the "Warriapolla" Biscuits, and for prime thick crêpe by "Rosehaugh" blankets.

We have mentioned some of the leading crack marks as examples of successful preparations, but there are many other marks fast approaching an equal standard of excellence, and there is no doubt in a very short time, as in the case of Fine Para, regular contracts will be possible, made simply upon a guarantee of a given mark that has established its reputation for quality and regularity, whether it be block, crêpe, sheet or biscuits.

In fact a good many contracts have already been entered into for crops and outputs, and with a continuation of the careful preparation which has made such strides during the past year, the forward and delivery business should present few if any difficulties.

WORMS

have been coming much darker in colour and, unless very pale, have been difficult to sell, we do not recommend this form of preparation.

CASTILLOA.

The quality of parcels sent during the past year has improved, but the colour has been very dark. A new machine is now in course of construction and we have valued some excellent strong sheet almost white, prepared by it; we have every confidence of a great future for this class of rubber when new methods are discovered and perfected.

FICUS ELASTICA,

prepared in crêpe form has always met a ready demand and we do not get nearly enough to supply even the smaller buyers.

THE MABIRA FOREST RUBBER

(Funtumia) has met with extraordinary success, which goes to show that other rubber beside Hevea, properly prepared and sent home in good condition, will meet with a quick and ready sale, and bring excellent prices.—LEWIS & PEAT, Rubber and Rubber Share Brokers.

## OUR PALM PRODUCTS FOR 1909.

The year being closed at the Customs we can now follow up our last review to end of the year. The year has undoubtedly been a very unusual one for all our coconut products.

Taking *Oil*, which seems to rule all the rest; first, we find a total export of 599,795 cwt. as compared with the figures for 1908, viz., 670,121 cwt., our very best in the history of this commodity, the soap-makers' principal ingredient, while it is daily coming more and more into prominence on the Continent and in America (U.S.) on account of the success of manufacture of butter or 'palmin' as it is called. The falling-off this year is not so great when we remember the excessive number of nuts it took during the second and third quarters to produce a candy of copra, some 1,300 to 1,400. Until, therefore, the soap-manufacturers find a cheap substitute, we do not think oil is likely to fall beyond ordinary trade fluctuations. To give our readers an idea of Java's importance as compared with Ceylon: Java sent to the *U.K.* in 1st quarter of *1908* 23,778 tons copra against Ceylon same period 3,219 tons copra. 1907 was the shortest copra year in the decade, Ceylon shipping only 1,861 tons against other countries 33,948 tons, that is for the 1st quarter to *U.K.* Take away Java and Singapore, and where would the soap man be?

The export of *Copra* for the year, however, is higher than last year, the figures being 748,739 cwt. in 1908 against 784,522 cwt. this year, or more than double of 1907, very little going to the U.K. Russia and Germany took the most, while none went to America, their supply coming doubtless from the Pacific. Were it not for the very inferior quality of the kernel, our export and local mill consumption would have been very much higher. Java sent U.K. *13,464* tons in 1907, and in 1908, 23,778 tons. Towards the middle or end of last quarter there was great activity in copra drying, and exorbitant prices were paid for nuts for drying, these going as high as R76 per 1,000, buyers being in hopes then of copra reaching R100 per candy. This is now R82 or only R5·50 per candy less than the record price of 1906—1907, when it reached nearly R87·50 and when nuts touched R75 per 1,000. Truly owners of estates are to be congratulated on being able to command such splendid prices for their nuts. At an auction in Negombo, about 30th December, over 100,000 nuts, not first-rate even, averaged R72 per 1,000 husking and carting extra.

*Desiccated Coconut*—verging on overproduction at end of 1908 with the 4,000,000 lb. increase over the record export of 1907—shows a falling-off of over 1,754,032 *lb.*, that is taking our tabulated figures for 1908 or 27,602,624 lb. against this year's total of 25,848,592 lb. export. This year, now under review, started very badly with but a poor demand and when prices were very low, caused no doubt by the big holdings in Europe and America. During last quarter, too, business was very dull—the trade no doubt having large supplies. In this the mills also felt the pinch of a very poor outturn, it taking from April to September nearly 3½ nuts to produce 1 lb. of desiccated nut. When this product is in demand, prices seem to follow oil and copra fairly well, but when holdings abroad are heavy nothing—not even wild rumours of any short nut crops, or short shipments—will raise its price, which, bad as the local market is, is generally from ½ cent to ¾ cent ahead of C.I.F. offers from Europe, so that local sales are on the increase when the seller gets paid at once. We happen to know of a desiccating mill where it took nearly 8 per cent more nuts to produce a case of 130 lb. in 1909 than in 1908. This will give an idea of the inferiority of our nuts during the year under review.

*In Nuts in Shell*—we have a heavy falling-off, our export table showing 18,405,186 nuts against 21,023,853 in 1908, by far our greatest shipment of the year, the largest number going to U.K., Egypt and Germany. The demand for nuts for shipping is generally very steady, and it only falls off when oil and copra go up and the demand for nuts for drying increases. Nuts have to be specially husked for shipping with sufficient husk left on to preserve the eyes.

There is a falling-off in *Poonac* as compared with 1908, the figures being 254,547 cwt. against 303,713 cwt. in 1908. As we pointed out before, the Copra crushing at home enables people to secure their cattle food poonac cheaper than they can procure it here and what we ship from Ceylon is the result of local milling and native chekoos after providing for local demand.

We have very little change to report in *Coir* beyond that yarn and fibre are both considerably short of 1908. Many mills recently shut down have not resumed work, and those that are working now are going very slow. There is a decided improvement in demand and price. Encouraged by the success of a few mills well situated for husk, several new mills were put up, but some have, to this day, not started work.

Reviewing the whole Coconut enterprise, it is most satisfactory to note that, while the bleeding disease is still with us, it is very amenable to Mr. Petch's treatment, and the most experienced planters have little fear of it. Nor do we see much chance of the demon "Overproduction" ever overtaking this enterprise. The present high price of oil, many predict, has come to stay. One thing is, we think, bound to take place, and that is, a better system of manuring and tilling of the gardens, the poorest villager being quite alive to the fact that their crops can be increased by from 50 to 100 per cent and even then there is lots of room for such an increase in production. What they do require is cheaper money, many of the gardens being heavily involved to the Natucotta Chetties with their crushing rates of interest. Many of the well-to-do proprietors are manuring more than they ever did.

## SOME RUBBER CROPS OF 1909.

CONSOLIDATED ESTATES CO., LTD.—Tea made 1st July to 31st Dec. 1909, 965,000 lb. Rubber made 1st July to 31st Dec. 1909, 39,000 lb.—ARBUTHNOT LATHAM & CO., General Managers.

MC MEEKIN & CO.'S QUARTERLY REPORT.

| 1st Jan. to 31st Dec. | 1909. lb. Harvested. | 1909. Av. of sales to date. | 1908. lb. Harvested. | 1908. Av. of sales to date |
|---|---|---|---|---|
| | | s d | | s d |
| Batu Caves Rubber | 43,527 | 7 1 5-8 | 16,585 | 4 1½ |
| Seafield Bubber | 43,490 | 7 4 | Nil | Nil |
| Pelmadulla Rubber (Geragama only) | 1,338 | 7 0½ | 946 | 3 8¼ |
| | | cents | | cents |
| Tea (from Factory) | 474,806 | 38·19*a* | 490,919 | 34·53*a* |
| | | s d | | s d |
| Mahawale Rubber | 1,827 | 6 10½ | 470 | 3 7½ |
| | | cents | | cents |
| Do Tea | 533,333 | 35·38*a* | 525,045 | 31·64*a* |

*a* Up to Colombo advices dated 10th December.

10 and 11, Lime Street, London, E C, January 3rd, 1910.

FEDERATED (SELANGOR).—10,521 lb. making a total of 71,638 lb. for the nine months, against 41,480 lb. in 1908.

NORTH HUMMOCK.—For the six months ended December 31st, 18,883 lb. against 2,868 lb. for the corresponding period of 1908.

PATALING.—21,950 lb. in 1908, 12,174 lb. wet; total for twelve months, 151,994 lb. against 80,922 lb. in 1908; increase, 71,072 lb.

P.P.K. (CEYLON).—5,772 lb. dry; last year, 3,332 lb. dry; increase, 2,440 lb. dry; total for year, 45,474 lb. dry; total for last year, 29,200 lb. dry; increase, 16,274 lb. dry.

SELABA.—October 1st (date the company took over) to December 31st, 8,959 lb.

SELANGOR.—38,525 lb; total for the year, 323,919 lb. compared with 187,992 lb. Para and 1,987 lb. Rambong in 1908.

SUNGEI KAPAR.—December, 18,500 lb; total for the year, 114,600 lb.—*Financier*, Jan. 6.

ANGLO-MALAY.—53,489 lb; corresponding month 1908, 34,865 lb; total twelve months 1909, 516,232 lb; total twelve months 1908, 350,688 lb; increase on year, 165,544 lb.

BUKIT RAJAH.—32,373 lb; total for the nine months of 1909, 194,525 lb, against 136,128 lb to end December, 1908.

CICELY.—8,928 lb, against 4,213 lb in December, 1908. Total crop from April 1st to December 31st, 1909, 60,235 lb, compared with 33,026 lb. for same period of 1908; increase, 27,209 lb.

CONSOLIDATED MALAY.—29,418 lb; total for the year 1909, 215,893 lb, compared with 111,585 lb. for 1908.

GOLDEN HOPE.—5,462 lb; corresponding month of 1908, 1,630 lb. Total for year 1909, 51,400 lb; total for year 1908, 15,660 lb; increase, 35,740 lb.

HIGHLANDS AND LOWLANDS.—46,078 lb; December, 1908, 23,000lb. Total for 1909, 341,986lb; 1908, 222,287lb. [Subject to adjustment after manufacture is completed.]

LONDON ASIATIC.—10,076 lb; corresponding month of 1908, 4,376 lb; total for twelve months, 76,202 lb; total for year 1908, 34,549 lb; increase, 41,653 lb.

PERAK.—1909, 10,150 lb, against 10,460 lb in December, 1908. Total crop from April to December 31st, 1909, 86,565 lb, compared with 46,994 lb for same period of 1908; increase, 39,571 lb.

SUMATRA PARA.—6,830 lb; corresponding month of 1908, 5,940 lb; total for six months of 1909, 53,880 lb; total for corresponding period of 1908, 33,720 lb; increase, 20,160 lb. Average net price realised for the company's rubber during December, 7s. 2·27d. per lb. The estimate of crop for the current season is increased to 110,000 lb. —*Financier*, Jan. 1.

SUNGEI CHOH.—For the year ended 31st December, 1909, 10,200 lb. for 1908 2,258 lb. Of the 1909 crop, 5,200 lb. have been sold in London at an average price of about 7s. 7½d per lb. gross.—T. A. WILLIAMS, Secretary, 4th Jan.

SEAFIELD.—December, 1909, 7,081 lb.; total fo year 1909, 43,490 lb.

BATU CAVES.—6,585 lb. against December, 1908, 2,276 lb.; total for the year 1909, 43,527 lb., against 1908 16,585 lb.

KEPONG (Malay).—To the end of November the crop of rubber collected was 21,066 lb. wet weight, against an estimate of 14,000 lb. dry weight for the whole year.

MALACCA.—29,000 lb., same month of 1908. 8,500 lb. total for 1909, 240,000 lb., against 46,890 lb. for 1908.

SUNGEI SALAK.—Crop secured to Dec. 31 to 5, 81 lb.

LINGGI.—December, approximately 59,000 lb., total for the year 527,000 lb., against 284,873 lb. in 1908.

LABU (F.M.S.) RUBBER.—December, approximately 13,960 lb., total for the year 86,500 lb., against 24,127 lb. in 1908.

ST. GEORGE RUBBER ESTATES.—For the year 23,109 lb. against estimate of 16,000 lb.

BANDARAPOLA CEYLON COMPANY.—For the year 804,300 lb. tea, 569 cwts. cocoa, 4,300 lb. rubber, as against 737,633 lb. tea and 489 cwts. cocoa for the previous season.

SEREMBAN—December 21,007 lb., in 1908. 11,832 lb. The total for 12 months was 228,626 lb., and 134,848 lb. in 1908. A survey of the Seremban Estate has just been completed, and a cable has been received stating that the exact area of the oldest rubber, planted in 1898, is 348 acres. The quantity of dry rubber produced from this acreage in the year 1909 just closed was about 205,000 lb., or at the rate of

590 LB. PER ACRE.

Of the above there will fall to be dealt with by the London company, when the accounts for six months to December 31, 1909, are made up, the following quantity, viz.: Production of dry rubber for six months to December 31, 1909, 124,036 lb., which compares with dry rubber for six months to December 31, 1908, 64,006 lb., showing an increase for six months of 60,030 lb. Of the above quantity the bulk has been sold under forward sales, averaging about R4·69 per lb., or, say, a net sterling price of about 6s. per lb.

SHELFORD.—December, 3,600 lb.; for year, 28,963 lb.

GLENDON.—Three months to December 31: Rubber, 9,400 lb.; increase, 3,180 lb.; tea 40,262 lb.; decrease, 330 lb.

GOLCONDA MALAY.—Dry rubber season 1909 to end of month of December, 95,443 lb.; increase 60,341 lb. Month of December, 15,028 lb.; increase, 9,576 lb.

GENERAL CEYLON.—For 1909, 38,370 lb. rubber, against an estimate of 28,500 lb. and a crop secured last year of 26,283 lb. The tea crop for the year is 3,051,000 lb., against 3,050,266 lb. last year.

CEYLON TEA PLANTATIONS.—The total amount of tea produced in the company's factories for the year 1909 was 5,515,000 lb., compared with 5,073,000 in 1908, and of rubber 54,000 lb., against 25,700 lb.—*H. & C. Mail*, Jan. 7.

## RUBBER IN THE F. M. S.

AND PEAT-SOIL.

We recently received from Pontianak two samples of a peaty soil in which rubber had been planted. The planter reported that the trees at 2½ years averaged 5·59 inches in circumference at 3 feet from the ground, which is decidedly small, but the trees were healthy though under-sized, and a good many seedlings had died. The soil sent consisted exclusively of decayed wood and leaves; not a particle of sand or stone was visible. I asked Mr. Dent, the Government Analyst, to examine the samples with a view of finding out what amount of mineral matter there was in this class of soil, which resembled exactly that obtained from Johore, and described in previous accounts of the peat-soils. Of the two samples A. was taken from the top of the ground to about 8 inches depth, and B. about three feet down. The owner of the land states that the soil seems to be similar to this for 15 to 20 feet depth, and that the whole soil on exposure has sunk a good deal. In appearance, the two samples were much the same except that the top soil was wetter, and the fragments of wood less decomposed, as might be expected. Mr Dent gave the following report:—

| | MOISTURE | ASH | ASH: FROM DRY SAMPLE. |
|---|---|---|---|
| A | 76·60 per ct. | ·33 per ct. | 1·43 per ct. |
| B | 56·90 do | ·94 do | 2·18 do |

This ash apparently consisted of the potash, a trace of iron, etc., derived from the decayed wood. There was, in fact, absolutely no mineral matter derived from the soil at all in the earth. To compare this with the soil richest in humus, decayed leaves and sticks in the Botanic Gardens, Singapore, where Para rubber is grown successfully, it may be pointed out that this soil contains upwards of 60 per cent of mineral matter, while other soils on which Para rubber grows well had up to 70 per cent and more of mineral matter. The increase of ash in the lower sample is doubtless due to the greater loss of organic matter in the course of decomposition, giving a higher proportionate return.

The amount of water retained in these soils is rather striking.

In the soils analysed from the Botanic Gardens (Bulletin VII 581) free water amounted to 7·400 per cent, in the wettest to 2·000 per cent in the driest. These soils were sent for analysis to Ceylon and one may allow perhaps a little loss from evaporation on the way. The Borneo soils, however, were kept some days after their arrival here from Borneo, and perhaps were proportionally wetter, still the difference in the amount of water retained in the lowest, which is the driest, amounted to 56·90. Warington writes: "Of all soils peat has the greatest capacity for retaining water, its porosity supplying an enormous internal surface, the effect of which is heightened by the affinity for water of its colloid constituents." Of course the peat he is referring to is not what we call peat in this country, it is rather more compact, the stems of the mosses, the heather roots, etc., being finer than the wood fragments of the so-called peat soils here, but, generally speaking, the result appears to be the same, and as decomposition has gone on to a considerable extent as it had in sample B, and the vegetable remains were quite broken up and powdery, there would be little difference between the two. The excess of water in the soil, if the water was saturated with humid acid would not be advantageous to the growth of Para rubber, as explained in previous papers.—ED.—*Straits Agricultural Bulletin*, January.

## CEARA RUBBER IN COORG.

I saw a good deal of Ceara Rubber, and was favourably impressed with its appearance. It must be remembered that this, like other crops, will respond to good soil, and good cultivation. Preliminary experiments made in a rough way without any special apparatus are yielding samples of rubber which are valued at top prices, so that the industry seems to be a promising one. The trees grow readily: if not so rapidly as in some other districts, still rapidly enough for practical purposes. It is possible that some trouble may be experienced with the tapping, but it should be possible to overcome this by the adoption of a system of vertical tapping, and the use of dripping tins containing Ammonia to induce a longer flow of latex. In a plantation of Ceara trees a large number of varieties will be found, and yield of rubber and latex will vary much from tree to tree. New clearings should be planted up from cuttings taken from a tree which has been found by experiment to give a good yield, since seed will not come true. I saw no season to suppose that this industry will prove anything but satisfactory in the district. —RUDOLPH D ANSTEAD, Planting Expert. 7-1-1910.—*Planters' Chronicle*, Jan. 22.

## LABUAN RUBBER LAND.

Labuan, Nov. 25.—Planters and others interested in rubber should certainly see Brunei before going elsewhere where land is clear and labour scarce. The terms offered by the Brunei Government to *bona fide* applicants are most advantageous, and excellent land is to be found. The Labu (Brunei) Co. have made a good start, a large area has been cleared and some 30 acres have already been planted. All this has been done with local labour.—*Straits Times*.